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DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF THE 1930–31 SEASON.

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THE results of the 1930–31 herd-testing year are largely a reflection of the general conditions which prevailed during that season climatically and economically, from the point of view of our dairy industry as a whole. While, in the circumstances, the number of cows tested was fairly well maintained, this was largely due to the operation of several new organizations, many of the older-established groups having shown a decreased membership. With butterfat prices severely reduced, and no immediate prospect of improvement, many dairy-farmers were doubtless forced to commit themselves to lower expenditure when the 1930–31 season opened. Climatically the season was unfavourable, and the average production suffered in consequence. The quantity of butterfat produced in New Zealand during the dairying year ended 31st July, 1931, was estimated to be about 2 per cent. higher than for the preceding twelvemonth, whereas the production of the average tested cow was 12·56 lb. of butterfat lower. Unfortunately, statistics of the dairy-cow population for the year under review are not available at the time of writing, but the production figures just quoted would indicate an appreciable increase in the number of cows in milk in the Dominion last season.

The returns for 1930–31, on the basis of all cows tested twice or more, show a total of 271,404, as compared with 283,731 for the preceding season, a decrease of 12,327 cows. Of the past year's total 88·8 per cent., or 241,155 of the cows, were tested under the Group system, while the remainder came under the Association own-sample test and the Dairy Company test respectively. For the benefit of any who may not be conversant with these titles the explanation may be repeated that under the Group system a testing-officer visits the farm and takes samples and checks milk weights once a month, whereas under the Association own-sample test and Dairy Company test the owner takes his own samples and milk weights, usually for two days a month, and the association officer or the dairy-factory manager arranges for the testing.

Table 1.—Number of Cows tested Twice or more, classified according to Season and System of Testing.

System.	1926–27.			1927–28.			1928–29.			1929–30.			1930–31.		
	Organizations.	Cows.	Average Cows per Organization.	Organizations.	Cows.	Average Cows per Organization.	Organizations.	Cows.	Average Cows per Organization.	Organizations.	Cows.	Average Cows per Organization.	Organizations.	Cows.	Average Cows per Organization.
Association	116	56,823	489	115	56,699	493	99	45,586	460	98	40,667	415	77	28,914	375
Group ..	96	109,827	1,144	127	164,610	1,296	158	212,480	1,344	184	242,688	1,319	193	241,155	1,249
Dairy Company	28	3,500	125	18	2,821	157	8	1,528	191	6	376	63	10	1,335	133
All ..	240	170,150	709	260	224,130	862	265	259,594	979	288	283,731	985	280	271,404	969

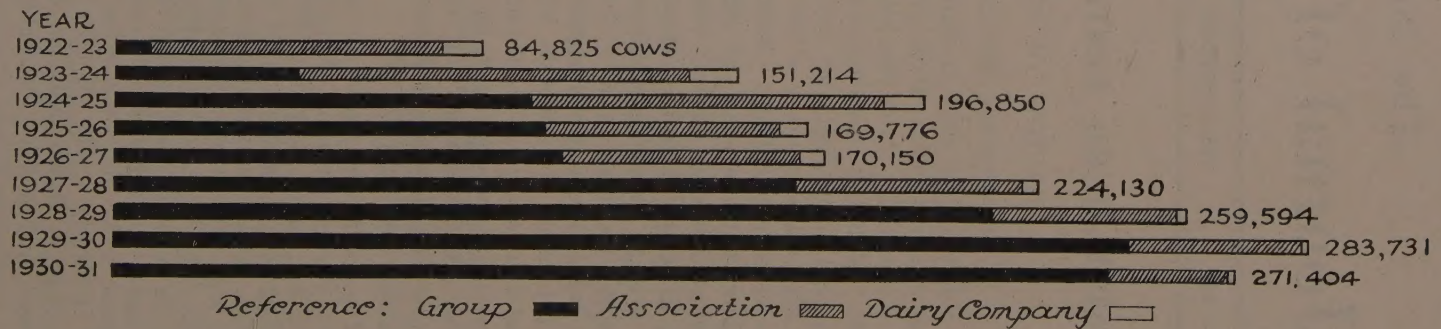

FIG. I. GRAPHICAL REPRESENTATION OF EXTENT AND SYSTEMS OF HERD-TESTING IN NEW ZEALAND FOR LAST NINE SEASONS.

Table 1 provides a classification of number of cows tested under the three headings referred to, five years' returns being included. The accompanying graph takes in the entire life-period of the Group herd-testing movement, which commenced with the 1922–23 season.

Table 2 provides a classification according to land districts of number of cows tested. The principal feature is the increase in the South Island total. This is almost entirely accounted for by the establishment of five new groups on the West Coast. So far as the table is concerned, however, it should be explained that although these five groups fall in the area commonly referred to as the West Coast, or Westland, two of the larger groups really come within the borders of the Nelson Land District, and must be classified accordingly. The falling-off in Southland is disappointing. It will be noticed that herd-testing in this land district has been steadily receding for the past four seasons.

Table 2.—Number of Cows tested Twice or more, classified according to Season and Land District, &c.

Land District, &c.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.
North Auckland	24,616	41,067	48,713	58,113	55,283
Auckland	82,338	101,796	106,823	109,811	102,534
Gisborne	2,626	5,756	9,579	12,329	10,418
Hawke's Bay	2,987	4,638	8,243	8,505	8,742
Taranaki	14,696	23,581	30,298	31,693	32,519
Wellington	29,517	32,267	36,547	42,224	35,875
North Island	156,780	209,105	240,203	262,675	245,371
Nelson	620	656	1,241	2,128	5,732
Marlborough	258	434	2,176	3,628	3,064
Westland	74	..	..	..	2,380
Canterbury	4,292	3,280	3,524	2,816	3,244
Otago	950	769	581	2,975	3,775
Southland	7,176	9,886	11,869	9,509	7,838
South Island	13,370	15,025	19,391	21,056	26,033
Dominion	170,150	224,130	259,594	283,731	271,404

Table 3 needs no comment, but is useful as a general survey of the work done during the year from the point of view of the number and size of the various units in operation. The term "organization" used in the table denotes any herd-testing body, whether Group, Association, or Dairy Company. Moreover, the term applies to each individual unit—that is to say, an organization operating ten groups is included as ten, not one. By an "effective" summary is meant that the table is compiled from individual summaries which appear sufficiently complete and reliable to justify inclusion.

Table 3.—Number of Cows, Herds, and Organizations represented in Effective Seasons' Summaries received. (Basis : All Cows in Milk 100 Days or over.)*

—	1928–29.	1929–30.	1930–31.
Number of organizations	257	282	270
Number of herds	6,663	7,107	6,347
Number of cows	245,811	272,554	260,469
Average number of herds per organization	25	25	23
Average number of cows per herd ..	36	38	41
Average number of cows per organization ..	956	967	964

* Including both Group and Association systems, and on basis of sections or units.

In Table 4 groups and associations are classified according to herds and cows. The gradual falling-off in the average size of the associations is naturally expected, in view of the general trend of the movement. A point which calls for comment, however, is the clearly defined falling-off in the size of the groups. Seeing that the Group system depends for economy of operation upon a membership as near as possible to the limits of convenient workability any retrograde trend in membership is undesirable. Conspicuous also is the steady increase in the size of the average herd per group, a desirable trend which probably can be interpreted to signify that more cows are being milked from the same area.

Table 4.—Average Size of Associations and Groups for which Effective Seasons' Summaries on the Basis of all Cows in Milk 100 Days or over were received.

System.	Season.	Average Number of Herds per Association or Group.	Average Number of Cows per Association or Group.	Average Number of Cows per Herd.
Association ..	1926–27	18	408	22
	1927–28	21	414	20
	1928–29	20	401	19
	1929–30	20	363	19
	1930–31	18	333	18
Group ..	1926–27	26	1,127	43
	1927–28	28	1,250	45
	1928–29	29	1,304	44
	1929–30	28	1,288	46
	1930–31	25	1,216	47

The figures in Table 5 are largely as might be expected from the introductory comments to this review. The average yield per cow is down by 12·56 lb. of butterfat, and the remaining production figures are correspondingly lower. It will be noted, however, that the average milking season per cow is unchanged. The number of herds represented in this table is 6,347, of which 4,983 were under Group test and the remainder of 1,364 under Association test.

Table 5.—Grand Summary of all Effective Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons.

—	1929–30.			1930–31.		
	Number of Cows.	Days in Milk.	Butterfat-production.	Number of Cows.	Days in Milk.	Butterfat-production.
			lb.			lb.
Average for all cows	272,554	247	253·61	260,469	247	241·05
Average for all Group cows ..	236,941	251	254·32	234,799	250	241·50
Average for all Association cows	35,613	223	248·88	25,670	225	236·90
Highest Group average ..	1,113	281	318·42	812	277	302·73
Lowest Group average ..	1,025	194	173·96	526	211	152·76
Highest Association average ..	5	293	440·93	4	275	405·00
Lowest Association average ..	108	143	150·04	54	187	139·62
Highest Group herd	7	275	455·43	12	286	430·25
Lowest Group herd	15	117	78·46	26	132	77·19
Highest Association herd ..	5	288	485·54	4	258	434·06
Lowest Association herd ..	12	139	71·19	2	107	67·91
Highest Group cow	..	350	886·00	..	324	724·00
Lowest Group cow	..	130	11·00	..	100	12·00
Highest Association cow ..	..	285	639·00	..	306	714·31
Lowest Association cow ..	..	100	20·00	..	100	27·00
Average daily production of butterfat for all Group cows	..	..	1·01	..	..	0·96
Average daily production of butterfat for all Association cows	..	..	1·11	..	..	1·05

In previous years tables have been given, prepared from Dairy Division figures, embodying a comparison of the Association test on the basis of all cows in milk 100 days or more and all cows in milk 210 days or more. This was considered a useful tabulation, but the Division has withdrawn from herd-testing to such an extent that on last year's returns only 2,719 cows would qualify for inclusion in the 100-days-or-more classification, and 1,787 of these for the 210-days section. These numbers are so small that it may be dangerous to assume them sufficiently representative, and it has been thought wise to drop this tabulation for the present.

Table 6 is a butterfat-production summary according to land districts, and covers four seasons. All land districts except Wellington are lower than last year. The table would be of greater value were it possible to combine with it a comprehensive survey of particulars relating to the conditions, from a dairying point of view, which obtain in each locality.

Table 7 provides an indication of the distribution, in 50-lb. classes, of the records for all cows tested in the Dominion during the period under review and for which effective summaries were received. The 1929–30 statistics are included for comparison purposes. The drop in average butterfat production is borne out by the analysis, the lower groups showing an increase.

Table 6.—Average Production, according to Land Districts, &c., of all Cows under Herd-test for which Effective Seasons' Summaries were obtained. (Basis: 100 Days or over.)

Land District, &c.	1927–28.			1928–29.			1929–30.			1930–31.		
	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.
			lb.			lb.			lb.			lb.
North Auckland	36,395	211	191·66	45,735	234	222·87	55,458	245	241·15	53,158	243	218·16
Auckland	95,799	235	225·04	102,239	247	238·27	106,549	256	260·27	99,042	253	243·95
Gisborne	5,244	231	234·39	9,045	233	230·45	11,606	236	234·62	9,899	235	225·13
Hawke's Bay	4,107	230	233·72	7,705	243	249·61	8,281	221	258·06	8,324	227	219·28
Taranaki	22,180	238	247·01	28,515	249	259·76	30,366	254	271·59	31,633	259	268·40
Wellington	29,300	233	244·89	34,524	243	257·93	40,343	242	246·80	34,152	248	252·29
North Island ..	193,025	230	224·72	227,763	243	240·92	252,603	249	254·03	236,208	249	240·97
Nelson	341	154	162·44	936	203	237·00	1,976	225	255·15	5,464	229	244·36
Marlborough	..	..	..	1,956	217	244·84	3,417	224	250·76	2,913	237	247·20
Westland	..	..	..	..	..	..	..	..	..	2,321	229	234·54
Canterbury	2,847	226	222·57	3,081	218	237·67	2,506	206	237·65	2,627	212	220·57
Otago	720	239	273·42	552	219	253·99	2,790	227	244·41	3,535	228	237·94
Southland	9,390	220	222·94	11,523	225	231·89	9,262	227	249·92	7,401	231	249·47
South Island ..	13,298	221	224·04	18,048	222	235·22	19,951	224	248·27	24,261	229	241·81
Dominion	206,323	230	224·68	245,811	242	240·50	272,554	247	253·61	260,469	247	241·05

Table 7. — Distribution of Records for all Tested Cows in the Dominion represented in Effective Annual Summaries received, Seasons 1929–30 and 1930–31. (Basis : 100 Days or over.)

System.	Class Limits (in Pounds of Butterfat).																	Total Number of Cows classified.
	Under 50.	50–100.	100–150.	150–200.	200–250.	250–300.	300–350.	350–400.	400–450.	450–500.	500–550.	550–600.	600–650.	650–700.	700–750.	750–800.	800–850.	850–900.	
1929–30.							*Numbers.*												
Association	24	841	3,526	6,378	7,993	7,289	5,300	2,634	1,149	343	106	20	10	..	..	..	..	..	35,613
Group ..	697	5,485	17,811	37,749	54,712	54,056	37,587	18,883	7,088	2,108	584	134	38	6	2	..	..	1	236,941
Both ..	721	6,326	21,337	44,127	62,705	61,345	42,887	21,517	8,237	2,451	690	154	48	6	2	..	..	1	272,554
							Percentages.												
Association	0·07	2·36	9·90	17·91	22·44	20·47	14·88	7·40	3·23	0·96	0·30	0·06	0·02	..	..	..	..	..	35,613
Group ..	0·29	2·31	7·52	15·93	23·09	22·81	15·86	7·97	2·99	0·89	0·25	0·06	0·02	*	*	..	..	*	236,941
Both ..	0·26	2·32	7·83	16·19	23·01	22·51	15·73	7·89	3·02	0·90	0·25	0·06	0·02	*	*	..	..	*	272,554
1930–31.							*Numbers.*												
Association	54	925	3,176	5,073	5,650	4,891	3,345	1,637	646	199	60	11	2	..	1	..	..	..	25,670
Group ..	729	7,156	21,980	42,669	55,905	50,599	33,141	15,221	5,449	1,469	360	88	24	8	1	..	..	..	234,799
Both ..	783	8,081	25,156	47,742	61,555	55,490	36,486	16,858	6,095	1,668	420	99	26	8	2	..	..	..	260,469
							Percentages.												
Association	0·21	3·60	12·37	19·76	22·01	19·05	13·03	6·38	2·52	0·78	0·23	0·04	0·01	..	*	..	..	..	25,670
Group ..	0·31	3·05	9·36	18·17	23·81	21·55	14·11	6·48	2·32	0·63	0·15	0·04	0·01	*	*	..	..	..	234,799
Both ..	0·30	3·10	9·66	18·33	23·63	21·30	14·01	6·47	2·34	0·64	0·16	0·04	0·01	*	*	..	..	..	260,469

* Data occurring, but relatively insignificant.

Organization and Subsidies.

The New Zealand Herd-testing Central Executive has had another busy year, and has covered much ground. It is felt that the work of this organization, combined with that of the Federation Supervisor of Herd-testing, Mr. C. M. Hume, has done much to prevent a further falling-off in herd-testing membership. Moreover, the Central Executive's reorganization of the method of allocating the Government subsidy to herd-testing is expected to bring greater value for money expended.

During the past few weeks the bulk of the 1930–31 Government subsidy of £8,000 has been paid out, a large proportion of that sum having been devoted to defraying the cost of establishing new groups. For 1931–32 the New Zealand Dairy Produce Board has agreed to augment the Government subsidy to the extent of £6,000. This sum, combined with the £8,000 which the Government has again undertaken to provide, should keep the movement on a sound footing.

It is desired once more to thank the officers in charge of herd-testing organizations for their ready co-operation in supplying the data which enables this brief statistical survey to be compiled. Some 95·9 per cent. of the total cows tested twice or more during the past season were represented in effective summaries received. Each year an improvement is noted in the manner in which association secretaries submit their returns, which fact is in itself an evidence of progress.

DEVELOPMENT OF PUMICE LANDS.

The annual report of the Director-General of Agriculture for 1930–31 makes the following reference to this matter :—

Excellent progress has been made with the breaking-in of land on behalf of the Lands Department under the provisions of the Land Laws Amendment Act, 1929. Two blocks, known as Ngakuru No. 1 and Ngakuru No. 2, are being dealt with in the Rotorua district. On Ngakuru No. 1 1,213 acres have been cleared, and of this area 1,160 acres have been sown in grass, with plantations, &c. On Ngakuru No. 2 an area of 1,975 acres was cleared to the 31st March, and 400 acres cultivated. Only a small area was sown in grass in the autumn of 1931, and the remaining portion of the block, consisting of approximately 3,000 acres, is to be grassed. A very careful record of the cost of development of these pumice lands is being kept. The actual cost of getting the land down in good pasture, based on a minimum wage paid of 14s. per day, works out at £7 15s. per acre. Provided that by suitable management and reasonable top-dressing the pasture can be maintained in a satisfactory manner, such expenditure should be payable. One section on Ngakuru No. 1 has been fully equipped as a demonstrational dairy-farm. Excluding stock the cost will work out at approximately £20 per acre, this including all necessary buildings and subdivision into small paddocks. Dairying will be commenced on this area approximately within twelve months of the burning of the scrub. The progress of this developmental work on waste pumice lands must be watched with great interest. If it proves successful the potentialities of settlement on a large scale are great; if it does not, it will prove once for all whether the settlement of such land is a sound policy, as the very best and most modern methods of grassing and maintenance of pasture are being adopted. It is interesting to note that the certified rye-grass in the seed-mixture used has given outstanding results, and emphasized the necessity of attention to strain in the laying-down of grassland on virgin country.

GRASSING EXPERIMENTS ON HILL COUNTRY IN WHANGAMOMONA COUNTY.*

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INTRODUCTION.

IN this *Journal* for March and June, 1927, the progress of regrassing experiments on secondary-growth country was given in some detail, and these articles should be again consulted and studied by those interested in conjunction with the following additional experiences on these areas during the subsequent four years. The main experimental sowings have now been going for seven years, and this time may be regarded as sufficiently long to enable very reliable data to be secured as an outcome of the seed mixtures sown under the varying conditions of farm management these have been subjected to. Let it be said at the offset no seed mixture in itself can be devised to grass primary-forest and secondary-growth country without vigilant and specialized farm management.

The question of fences, class of secondary growth being tackled, when to burn, when to sow, when to stock, class of stock, how to stock, and how best to maintain soil fertility, all come in for consideration. Hill-country farming on primary- and secondary-growth country is intimately bound up in shepherding the country rather than in shepherding the stock. Literally, much hill country has to be hammered into grass with often little regard to the well-being of the stock engaged. The grass-seed mixture sown and the manuring of the sward secured will very largely determine just how hard the stock are to be punished in order to control the secondary growth that comes away after the fire. To my mind there is nothing worse than the forcing of stock on to dense secondary growth without first making an endeavour to get some grass to support the animals in their work of crushing. I know full well this is a criticism of a practice that has been used in the past and is advocated still by many large runholders; but, in my opinion, much good country brought in in this way that is now carrying danthonia, sweet vernal, Yorkshire fog, and catsear dominant should be carrying very much better species of grasses and clovers.

In the *Journal* for June, 1927, were detailed some eight methods of breaking in secondary-growth country. Continued observations during the four years since that article was written have tended to confirm the views there outlined rather than otherwise. In this and subsequent articles it is hoped to depict subsequent developments, and to illustrate, largely by means of photographs, some of the principles outlined there in operation.

I would again emphasize the fact that successful breaking-in of primary-forest and secondary-growth country is decided not on any

* For details of experimental sowings, locations, &c., for 1924 see *N.Z. Journal of Agriculture*, August, 1924; for 1925 and 1926 sowings see issue for February, 1927; and for interim results of these experimental sowings see issue for March and June, 1927.

FIG. 1. SPORELINGS OF WATER FERN ESTABLISHING ON PRIMARY BURN IN A SHADY CREVICE BETWEEN BUTTRESS ROOTS OF A KAMAHI.

Photo taken in winter following the burn.

FIG. 2. SPORELINGS OF BRACKEN FERN, WATER FERN, AND HARD FERN, TOGETHER WITH MASSES OF LIVERWORT (*Marchantia* sp.), ESTABLISHING ON A PRIMARY BURN UNDER SHADE OF EXPOSED ROOT AND ON SMALL SHADY BANK.

Photo taken in winter following the burn. In both photos there is insufficient grass established to offer any aid in control of secondary growth in the sporeling stage.

[*Photos by E. Bruce Levy.*

one single factor, but on a number of factors, any one of which being absent or inefficiently exploited may entirely offset the good of the rest.

Fencing is imperative. A good hot burn is often half the battle in connection with both primary and secondary burns. Tracking of the primary burn is essential where much timber is left unburned. The firestick is the cheapest of all hill-country implements, and where it can be used it should be employed in preference to crushing by stock. Next in importance to the firestick is the grazing animal. Cattle take first place, then wethers; horses in numbers are very effective; and for shrubby secondary growth, such as blackberry, and for tutu, the goat is unexcelled. Where the firestick cannot be effectively used, and where no class of stock is effective, the slash-hook or grubber wielded by the arm of man stands as the third major implement in secondary-growth control. Of recent years there has been added a fourth implement—plant-poisonous sprays applied by means of the knapsack spray-pump.

In this and subsequent articles discussing the experiments at Whangamomona it is intended to illustrate these major hill-country implements at work, and to show how each is essentially linked up with the making of a sward by sowing and top-dressing.

1. The Primary Burn.

Thirty-five acres of primary burn have been sown experimentally—5 acres in 1924, 10 acres in 1925, and 20 acres in 1926. The seed mixtures used on these are given in the *Journal* for August, 1924, and February, 1927. For convenience of reference they are repeated in the following table:—

Experimental Grass-seed Mixtures sown on Primary Burns, Whangamomona County.

Mixtures.	Sown in 1924.		Sown in 1925.				Sown in 1926.						
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Perennial rye-grass	6	6	..	6	6	..	..	6	6	..	6	6	3
Italian rye-grass	2	2	2	2	2	2	2	2	2	2	2	2	2
Cocksfoot	8	8	15	8	4	..	15	8	4	15	8	4	6
Crested dogstail	4	6	4	4	4	4	4	4	4	4	4	4	4
Brown-top	1	2	½	1	2	3	½	1	2	3	1	2	2
Danthonia pilosa	3	6	..	1	2	3	..	1	2	3	1	2	2
White clover	½	½	1	1	1	1	1	1	1	1	1	1	1
Lotus major	½	½	½	½	½	½	½	½	½	½	½	½	1
Lotus hispidus	½	½	..	..	..	1	½	½	½	½	½	½	1
Subterranean clover	½	½	⅛	⅛	⅛	⅛	½	½	½	½	½	½	½
Yarrow	..	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16	1/16
Poa pratensis	½	½	..	..	..	..	..	..	..	..	..	..	..
Paspalum	4	4	1	1	1	1	2	2	2	2	2	2	2
Chewings fescue	..	1	..	..	..	..	..	4	..	..	..	..	..
Hard fescue	..	..	..	..	..	..	..	..	4	..	..	..	..
Sheep's fescue	..	..	..	..	..	..	..	..	..	4	..	..	..
Rhenish tall fescue	..	..	..	..	..	..	6	..	..	..	..	..	4
Meadow foxtail	4	..	..	..	..	..	..	..	..	..	..	..	..
Timothy	2	2	..	..	..	..	..	..	..	..	..	..	..
Poa trivialis	1	..	..	..	..	..	..	..	..	..	..	..	..
Meadow fescue	6	..	..	..	..	..	..	..	..	..	..	..	..
Red clover	2	1	..	..	..	..	..	..	..	..	..	..	..
Rape	1	1	..	..	..	..	..	..	..	..	..	..	..
Total per acre	46·5	41·7	24·2	24·7	22·7	15·7	32·1	30·6	28·6	20·6	26·6	24·6	28·6

(⅛ lb. = 2 oz.; 1/16 lb. = 1 oz.)

FIG. 3. PIECE OF LIGHT PRIMARY BURN WHICH WAS NEITHER SOWN NOR STOCKED.

A mass of secondary growth must inevitably follow such an establishment. Showing in the photo are wineberry, fuchsia, tupari, bush-lawyer, rangiora, hard fern, five-finger, kamahi, and catsear.

FIG. 4. DENSE THICKET OF SCOTCH THISTLE ON A PRIMARY BURN ONE YEAR OLD.

Very little grass remains when so dense a crop of thistle occurs. A certain amount of grass, however, manages to seed in its shade, and when the thistle crop opens up these shed seeds again establish. White clover often becomes dominant later in these patches.

[*Photos by E. Bruce Levy.*

The table gives the experimental mixtures sown; the following is the seed mixture recommended after some seven years' study of the behaviour of the species and the amounts of these that were sown :—

Seed Mixture recommended on Primary Burns, Whangamomona County.

	lb.
Perennial rye-grass	12
Italian rye-grass	4
Cocksfoot	8
Crested dogstail	3
Poa pratensis	1
Brown-top	1½
Danthonia pilosa	3
White clover	2
Lotus major	1
Total per acre	35½

One pound per acre of turnips may also be added, but the usual practice is to sow these before the grass-seed mixture. Unless good control of the burn is possible by way of stocking, the Italian rye-grass should not be included.

Regarding seed mixtures for primary burns, research work in New Zealand and in Britain has demonstrated that the simple mixture is ecologically and economically more sound than is the complicated mixture. The more uniform the conditions over a given area the fewer the species required in any one sowing, but when it comes to primary-burn hill-country sowings there are other aspects to be considered. No bush-burn area is uniform so far as soil conditions are concerned, nor is it possible economically to make the soil conditions uniform. There are good slopes, small flats, and hollows associated in the same area with steep faces and exposed hard knolls that dry out in the summer. Again the initial conditions as regards soil fertility are quite dissimilar to the fertility conditions that will rule after the wealth of the ash of the primary burn is exhausted.

Thus the primary-burn hill-country seed mixture at the one sowing must provide for a number of conditions that do not exist in the ploughable country or even later on in the secondary-growth country. These conditions are: (1) A temporary high fertility in an extremely available form; (2) a medley of soil-types on any one given area; (3) strong volunteer weed-growth; (4) ultimate reduction all over the area in the soil-fertility standard. One is therefore forced to abandon the simple seed mixture on hill-country sowings and adopt the more complicated. The above-tabulated seed mixture may be said to cater for three phases.

The turnip, Italian rye-grass, and perennial rye-grass are essentially to exploit the high-fertility phase, and to act as rapidly as possible as a means of holding large numbers of stock to effectively control secondary growth in its establishment phase. The cocksfoot, crested dogstail, white clover, and Poa pratensis, with some perennial rye-grass, will carry well on after the initial flush of high fertility. The brown-top, Danthonia pilosa, and Lotus major are essentially the harder-condition grasses that take up the running first on the lower-fertility aspects—steep faces, hard knolls, pukahu areas, &c.—and then later, when the rye-grass and cocksfoot weaken, become general as the dominants of the sward. I would here like to allay any fear

of these second-rate grasses usurping the place of the rye-grass, cocksfoot, white clover, and dogstail while the conditions are satisfactory for these latter to thrive. If the soil is naturally fertile, or if surface fertility can be maintained by top-dressing, these high-productive grasses will keep the second-rate grasses in check, but even on the best country there are steep slopes, poor dry knolls, &c., that cannot economically be maintained at the high-fertility standard demanded by the first-class grasses and clovers.

In the experimental work at Whangamomona this grouping together of species according to habitat has been most marked—so marked in many cases that some settlers have expressed the opinion that the seed sown was not properly mixed or was carelessly sown. Each species

FIG. 5. TRACK MADE IN A PRIMARY BURN.

The destruction of secondary-growth seedlings and sporelings depends on whether stock are enabled to graze the area. This is only possible if they can get about the burn.

[*Photo by F. Bruce Levy.*

or set of species in the mixture sown becomes dominant in the burn according to the aspect and soil conditions. If it were practicable to sow all aspects with a different seed mixture, then we could use the simple seed mixture to greater effect, but when one comes face to face with the problem of sowing these primary burns the recommendation of even two seed mixtures becomes problematical, particularly when outside labour is employed to do the sowing.

Where it is practicable to vary the seed mixture the rye-grass and cocksfoot should be reduced and the Poa pratensis eliminated on the harder country, and the brown-top and danthonia may be somewhat increased. There is, however, so little variation that I am inclined to recommend keeping to the one standard mixture as given above.

The provision of temporary feed on the primary burn may, offhand, be considered extremely unwise and unsound. The primary burn, it may be claimed, is the one and only chance of getting permanent species into the country, and that this opportunity should not be imperilled by a large growth of temporary feed that will soon run out and leave bare ground. In the 1924 sowings 2½ acres were sown with turnips and 2½ acres without turnips. After seven years it is not possible to see any difference between the two parts. There are two factors in the primary burn that rule out the objection to temporary elements, particularly in the country under review: (1) The volunteer growth of Scotch thistle, and (2) timber left and secondary growth following after the burn. It would appear now that from one end of New Zealand to the other the whole of our forests have been seeded down with seed of Scotch thistle blown in from already established grassland where this weed has been allowed to flower and seed freely. These seeds remain dormant on the forest floor until the shade of the forest is destroyed by the felling and burning, and unless an intensely hot white burn is secured a crop of the thistle is bound to follow.

These plants in their rosette growth-form occupy more ground than a large-sized turnip, and by their tall growth smother worse than any temporary grass species that could be included in the seed mixture sown. I do not for a moment recommend the withholding of permanent species from the primary burn. These should certainly be sown and for all aspects, but where Scotch thistles are bad following the burn a supply of temporary feed in the form of turnips or Italian rye-grass leaves less room for thistles and enables a greater stocking that may tend further to reduce the thistle crop. Logs also occupy much ground, and the removal of these later by secondary burns furnishes a second excellent opportunity of getting in additional permanent grasses and clovers.

A good hard burn makes a wonderful difference not only in the amount of Scotch thistle that establishes and in the amount of log remaining, but also in the amount of secondary growth that comes away the winter following the burn. The ground floor of the forest is thickly strewn with seeds and spores of secondary growth, and, unless the burn is sufficiently hot to consume these, a crop of seedlings and sporelings inevitably follows (Figs. 1, 2, and 3). Wineberry, fuchsia, mahoe, waterfern, braken fern, and hard fern are probably the most dominant in the Taranaki country under review. Provided stock can get to these plants of wineberry and other tree seedlings, they soon disappear, being readily eaten. Treading of cattle and sheep and grazing by these animals largely reduces the amount of fern established. This brings up the very important point of tracking the primary burn (Fig. 5). No matter what species have been sown or how good the take, if stock cannot get at the feed owing to timber a mass of secondary growth will result.

A hot burn also reduces pukahu, that spongy mass of roots and leaf-mould which occurs on the floor of most primary forests. In one of our primary-burn sowings in 1926 the seeding was done in the main on such a seed-bed. In 1928—a dry summer—practically the whole of this pukahu mass was burnt, and much of the area had to be resown. The cleaning-out of pukahu in the original burn makes a great difference to grass establishment and the ultimate sward. Here again, however, the primary-burn farmer is entirely at the mercy of the elements.

FIG. 6. A CENTRE OF SECONDARY GROWTH.

Logs and other timber left after the burn offer every chance for secondary-growth establishment and spread. Photo shows water fern well established and protected by the fallen log.

FIG. 7. STANDING STUMP AS A CENTRE OF HARD-FERN ESTABLISHMENT AND SPREAD.

[*Photos by E. Bruce Levy.*

The fencing of the primary burn presents a problem. The value of fences is inestimable as a means of stock-control on the area to be grazed, and their erection is really a great feat, both in skill of erection and in choice of a site. Both are essential in farming hill country. Ridge boundaries are invariably chosen where at all possible, both from the point of avoiding damage to the fence subsequently by slips and in helping to separate shady faces from sunny faces. All standing trees that later would endanger the fence by falling on it are felled when clearing the fence-line.

The grassing experiments on the primary burn consisted largely in determining a standard primary-burn seed mixture for the Whangamomona class of country, and it was hoped to glean some information on the part the seed mixture played in avoidance of the fern and scrub successions which normally arise on that country. There is a feeling that if the farmer in the initial stages of breaking in that country had more specific knowledge on suitable seed mixtures to sow, virtually all secondary-growth problems would disappear or would never arise. This point is of immense importance to decide one way or the other, for on it depends largely the potential value of that country as determined by viewing it in its virgin state. If the country can be successfully grassed by closer attention to seed mixtures, fencing, stocking, &c., without deterioration and the consequent loss of feed and need of further burning and reseeding or necessity to severely punish stock, then the potential value of that country is great, whereas if breaking-in and maintenance costs are high then the original value of that country is low and may even be of a minus nature.

The experience of the past seven years on primary-burn grassing in Whangamomona County holds out little hope of avoiding the appearance and spread of certain classes of secondary growth. True, given a good burn and the most suitable seed mixtures, the class and amount of secondary growth that puts in an appearance can be largely governed, but I claim on no conditions could a sward entirely free of secondary growth be secured from the offset on primary-burn country of Whangamomona and similar country. Wineberry, fuchsia, water fern, and bracken can largely be controlled, but in controlling these the conditions are rendered extremely favourable for the spread of hard fern, and this secondary growth may dominate the burn after some four years, despite the seed mixture sown and irrespective of how careful the stocking. The successful establishment of brown-top, Lotus major, and Danthonia pilosa in the initial seeding does greatly slow up the spread of hard fern, and even though the swards are overrun with hard fern these species persist to some extent in the hard-fern growth and come away after a secondary burn has been secured.

Secondary burns, then, of logs, timber, and secondary growth must be regarded as part of the breaking-in processes of hill country from the primary forest, and the cost of reseeding such burns and the loss of feed sustained during the period leading up to a sufficiently dense growth to carry a second fire must all be taken into account in putting an initial value on primary-forest country.

There is no doubt, however, that the seed mixture sown does play an enormous part in the ultimate successful breaking-in of primary-forest country. Even though we have to face hard-fern encroachment

FIG. 8. LOGGING-UP A BURN.

This operation not only eliminates harbourage for secondary growth, but when the ashes are sown adds so much more grazable land.

FIG. 9. PRIMARY BURN IN FOREGROUND, SHOWING SMALL FLAT WHICH SIX YEARS PREVIOUSLY WAS A MASS OF TIMBER AND SCOTCH THISTLE FOLLOWING A BAD BURN.

The track scene shown in Fig. 5 was taken on this flat. A log fire is seen on the left.

[*Photos by E. Bruce Levy.*

and secondary-timber and hard-fern burns, yet from my experience up to the present the hard-fern phase can be regarded as a step nearer permanent grassland than any other type of secondary growth. The hard-fern growth of the young burns helps to clean up the timber in subsequent secondary burns (Fig. 10). This, however, may be regarded as a poor recompense for the loss of feed sustained by the actual growth and spread of the hard fern. To my mind, however, no hill country in Taranaki will be free of fern and rubbish until all timber is removed either by rotting out or by burning (Figs. 6 and 7). Logging-up the primary burns, then, should be regarded as a further breaking-in cost, and the more log and stump fires that can be lighted

FIG. 10. AREA CLEANED UP BY A GOOD SECONDARY FIRE WHERE HARD FERN HELPED GREATLY TO CLEAR THE TIMBER.

Note the patch of hard fern and timber in mid-right of photo that was missed by the secondary burn.

[*Photo by E. Bruce Levy.*

during those dry periods—unhappily often too short and too far between—the sooner will the country be safe from secondary-growth dangers (Figs. 8 and 9).

The experiments at Aotuhia, on the property of Mr. A. Murphy, may be cited as probably typical of the course a normal primary burn will take under good average farming methods as regards fencing, seeding, and stocking. (Figs. 11 to 13.) In 1924 a good average burn was made and a really good take of grass was secured — dominantly rye-grass, cocksfoot, crested dogstail, white clover, brown-top, and Lotus major—during the early years. The seed mixtures sown on this block are given in Table 1. The lower and better slope received mixture 1, and the upper and harder slope mixture 2. Scotch thistles were bad on all the easy and

better country, and so dense in parts as to smother out virtually all sown grasses (Fig. 4). The thistle phase lasted well into the second year of the burn, and during this time the grass sward plus the stock held well in hand the water fern, wineberry, and bracken fern established from spores and seeds after the burn. Hard fern, however, at the end of four years had dominated the burn wherever logs and timber stood, or where the grass sward was at all weak.

In 1928, four years after the original burn, the area was bad with hard fern. During this year we were fortunate in getting a good secondary fire that cleaned up most of the hard fern and timber. A certain amount of brown-top, Lotus major, and danthonia

FIG. 11. GENERAL VIEW OF THE 5-ACRE PRIMARY-BURN AREA SOWN EXPERIMENTALLY IN 1924.

Three-fifths of the same area was again burnt and resown in 1928. The photo was taken in 1930, when the area could not be said to be successfully grassed. To what extent hard fern will reappear time alone will tell. The 5-acre plot boundary runs to ridge somewhat to right of standing rimu-tree on right of photo.

[*Photo by E. Bruce Levy.*

came away after the second burn from the original seeding, but it was thought expedient to resow all the area burnt by the secondary fire. The following secondary-burn seed mixture was sown over approximately three out of the five acres: Perennial rye-grass, 6 lb; cocksfoot, 4 lb.; crested dogstail, 4 lb.; brown-top, 2 lb.; Danthonia pilosa, 3 lb.; paspalum, 2 lb.; white clover, ½ lb.; Lotus major, ½ lb.

The conditions in 1930 when the photo reproduced in Fig. 11 was taken were an almost complete cover of grass, dominantly brown-top, white clover, Lotus major, Yorkshire fog, cocksfoot, rye-grass, and crested dogstail. Chewings fescue, danthonia, and yarrow showed on the drier knolls, with odd plants general of paspalum and subterranean clover. Some piripiri and patches of hard fern that

FIG. 12. GENERAL VIEW OF PART OF 10-ACRE PRIMARY-BURN AREA SOWN EXPERIMENTALLY IN 1925.

The finer grasses dominant were sown on the steeper face on the felt, which has since slipped somewhat. There is little difference in any of the plots as regards secondary growth, but the area on the whole has grassed moderately well. Some 3 to 4 acres on the 10-acre block now require burning and reseeding. Compare with Fig. 13.

FIG. 13. EXPERIMENTAL AREA (FIG. 12) SOWN 1925 SHOWING ON LEFT OF PHOTO, AND PORTION OF BURN ON RIGHT NOT SOWN UNTIL FOLLOWING SPRING.

There is double the amount of hard fern present on the latter portion, indicating the importance of a good take of grass to encourage working of stock right from the onset.

[*Photos by E. Bruce Levy.*

were too small to burn in 1928 still remain, and there has been some spread of hard fern from small pieces that were not killed outright by the fire. It remains for the future to see whether the grass sward now existing under normal stocking will hold the hard fern, or whether within a few years there will again be the call for another secondary fire and subsequent reseeding. No top-dressing has been done on this area.

From experiences to be detailed later in dealing with secondary-growth control it certainly would appear that a good sward slows up return and spread of hard fern, but some more drastic method may yet have to be employed before 100-per-cent. control of hard fern over the whole area can be attained.

The 1925 and the 1926 seedings (see Table 1) aimed largely at a comparison between dominant first-class grasses and clovers as against heavy seedings of the second-rate grasses such as brown-top and danthonia. As far as keeping the country clean is concerned, there is practically no difference in any of the mixtures sown, and at the present time both areas have about 30 to 40 per cent. cover of hard fern. In 1930 it was intended to clean up the 1925 sowings, but there was too much rain to get a burn.

In striking contrast to the experimental sowings of 1925 was an area adjoining, burnt at the same time but which was not sown until the following spring (Fig. 13). This area now contains double the amount of secondary growth, mainly hard fern, as the adjoining autumn-sown plots. It serves to show well the importance of the seed mixture and the effect the sward has in giving at least partial control of the secondary growth. Where there is no grass owing to ground missed in seeding, or where only temporary species are sown, or where stock cannot penetrate owing to logs and timber, there is found dense secondary growth of one form or another.

It may be held that so far as grassing the primary burn is concerned the experiments have not been a great success. Nevertheless, the areas have carried well, and with watching and treatment the trend in favour of grass will be definitely established, a development which it is hoped will mean easier going for the settler on that class of country.

I would here like to express many thanks to Mr. A. Murphy, of Aotuhia, on whose property most of these experiments have been sown, for the assistance he has rendered to the work on every occasion and in every possible way.

(Series to be continued.)

Orchard Registration and Orchard-tax.—The number of registered orchards in the Dominion at 31st March, 1931, was approximately 6,050, representing some 3,000 taxable and 3,050 non-taxable; £1,400 was collected in orchard-tax by the Department of Agriculture in 1930–31, which amount, less cost of collection, was as usual handed over to the New Zealand Fruitgrowers' Federation, Ltd., for furthering the interests of the fruitgrowing industry generally.

TYPES OF RAPE USED IN NEW ZEALAND.

PRELIMINARY INVESTIGATION WORK.

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IT is generally assumed that variation exists in the type, yield, and fattening qualities of rape, which is sold in New Zealand under several varietal names. The purpose of the investigation here described is to determine these variations.

Samples of seed were obtained from merchants in all parts of New Zealand. Most of these were imported, only very few being definitely designated "Colonial." Seed was sown in nursery beds at the Plant Research Station on the 30th October, 1930, in rows 1 ft. apart. On 4th December, five weeks after sowing, the plants were 6 in. high, and were transplanted 30 in. apart each way. This operation was concluded in one day and, although it was very hot, few misses occurred. On 20th January, 1931, approximately twelve weeks from sowing and seven weeks from transplanting, the crop was ready for a first feeding-off. It would not have been economical to have fed it off earlier, but it could have been left without deterioration for some weeks. Most farmers like to see the crop "mature" and a blue tinge appear in the leaves before grazing. This stage was not reached till much later.

Inspection at this time revealed that there were three types of rape represented, and subsequent observation confirmed this. These types may be described as follow:—

Type 1 (Figs. 1, 2, and 4).—A tall upright-growing plant, with large broad leaves and thick leaf-stalk. The leaves are not numerous, being only about one-half or one-third the number to be found on a plant of Type 2. The crown is open and the broad leaves pendulous. As growth advances towards winter (and seeding), a central stem is developed 12 in. to 18 in. high, from which lateral stems arise also from 12 in. to 18 in. long. These lateral shoots, which later develop into thick woody stems, are not numerous. It is presumed that Type 1 is the Giant rape or French rape of commerce. There is considerable variation within the type.

Type 2 (see all figures) is characterized by the production of a mass of small leaves forming a dense crown. At the stage of maximum production it is 9 in. to 10 in. shorter than Type 1. The stem is short and produces numerous lateral shoots. There is very little variation within the type, several lines closely approximating 100 per cent. purity. While young the plants can be distinguished from Type 1 in having a darker bluish-green colour.

Type 3 (Figs. 1, 2, 3, and 5) is distinctly flat and spreading, and the foliage is a very deep blue-green colour. In a few cases the crown is moderately dense, but in the majority of cases this density develops late in the season. Most plants are very open in the crown, and the leaves are not numerous. The leaves are much dissected, reaching even to the mid-rib. Lines falling into Type 3 are in general very pure. It was evident quite early in the trial that Type 3 is very undesirable. Both initial yield and recovery are poor. Eventually

FIG. 1. TYPES OF RAPE IN NEW ZEALAND.

Top—Type 1, a giant form; centre—Type 2, a dwarf multi-leaved type; bottom—Type 3, a flat blue-green and very undesirable type. Photographed 17/2/31.

[*Photos by H. Drake.*

FIG. 2. SINGLE PLANTS OF THE VARIOUS TYPES OF RAPE.

Top—Type 1; centre—Type 2; bottom—Type 3. The same peg has been placed against each plant; in Type 1 only the top of the peg is visible, where indicated by arrow. Photographed 17/2/31.

[*Photos by H. Drake.*

FIG. 3. SHOWING VARIATION IN RECOVERY BETWEEN TYPE 2 ON LEFT OF PEG AND TYPE 3 ON RIGHT.

Photographed 17/2/31.

FIG. 4. COMPARISON BETWEEN TYPE 2 (ON LEFT) AND TYPE 1 (ON RIGHT).

Photographed on 19th May, 1931, when Type 1 was commencing to throw out flowering shoots. At this stage Type 2 was showing no signs of flowering.

[*Photos by H. Drake.*

the plants ran to seed very much earlier than Types 1 and 2. On 19th May, 1931, Type 3 had developed seed and seed-pods, but not a single plant of Type 2 and only a very odd plant in Type 1 had shown any signs of seeding.

FIG. 5. TYPE 2 (TOP) AND TYPE 3 (BOTTOM), GROWING IN ADJOINING PLOTS AND PHOTOGRAPHED ON 19TH MAY, 1931.

Practically all Type 3 plants had either died or seeded. Note also comparison in recovery seen in background.

[*Photos by H. Drake.*

TRIALS OF DIFFERENT LINES.

Altogether thirty-three lines of rape were placed under trial. Each trial consisted of two rows of twenty-two plants. The 30 in. spacing allowed each individual plant to be examined. The yield and recovery of each line were computed by taking the yield and recovery of each plant and finding the average. The trial was divided laterally into four blocks—A, B, C, and D—each receiving different treatment. Blocks A and B were cut back on 14th January. Block A was cut back very severely and B only lightly. Similar treatment was adopted

in subsequent cuts. Block C was cut back for the first time on 18th February, and thereafter received similar treatment to Block B. Block D was not cut, and afforded material for observations on the matured plant.

It was soon apparent that some of the lines were of mixed type and were of no use for the purposes of this trial. These are enumerated as follows, and thereafter not included in any of the results: Station No. 180, Broad-leaf Essex; No. 181, Giant rape; No. 184, Broad-leaf Essex; No. 187, Broad-leaf Essex; No. 189, Broad-leaf Essex; No. 190, Broad-leaf Essex; No. 191, Kangaroo rape; No. 197, Rape (unspecified); No. 210, Broad-leaf Essex; No. 211, Kangaroo rape.

The following tables and comments thereon record observations made during the season on the twenty-three lines deemed pure enough for the purpose:—

Table 1.—Rape Trials, 1930–31.

Station No.	Trade Name.	Leaf-density, 0–10.	Yield on 18/2/31: Pound per Plant.	Total Recovery after Four Cuttings (0–10).	Proportion of Flowers, 22/7/31, Block D (0–10).
		Type 1.			
182 ..	B.L.E.	4·3	3·2	4·8	0
186 ..	B.L.E.	5·8	3·6	4·6	1
192 ..	Ennobled ..	5·7	5·3	6·1	0
207 ..	B.L.E.	6·0	4·5	7·7	4
209 ..	Ennobled ..	5·5	4·8	7·7	2
15 ..	Ennobled B.L.E. ..	5·7	5·0	8·0	4
202 ..	B.L.E. (French) ..	6·8	5·0	7·0	6
Average for Type 1	..	5·7	4·5	6·6	2·4
		Type 2.			
185 ..	B.L.E.	6·6	3·3	5·7	0
188 ..	B.L.E.	6·3	3·6	6·7	1
198 ..	Rape	7·0	4·6	7·9	1
199 ..	B.L.E.	6·9	4·4	8·2	1
200 ..	Kangaroo ..	6·7	4·7	9·0	1
201 ..	Rape	6·6	4·4	8·5	2
203 ..	B.L.E. (Dutch) ..	6·5	3·5	7·3	1
204 ..	B.L.E. (Dutch) ..	6·8	4·0	9·0	2
205 ..	B.L.E. (Dutch) ..	6·4	3·4	8·2	1
206 ..	B.L.E. (Dutch) ..	6·4	4·1	8·4	1
208 ..	B.L.E.	6·0	4·2	8·6	3
212 ..	B.L.E.	6·0	5·0	8·3	0
Average for Type 2	..	6·5	4·1	8·0	1·2
		Type 3.			
183 ..	B.L.E.	5·4	2·0	3·1	10
194 ..	Colonial	6·1	3·8	5·7	10
195 ..	Kangaroo ..	6·3	3·8	5·4	10
196 ..	B.L.E.	5·9	2·7	5·1	10
Average for Type 3	..	6·0	3·1	4·8	10

Table 2.—Comparison of Recovery per Plant (0–10) between Types 1, 2, and 3, arranged according to Cuts.

Type No.	Recovery, 17th February.	Recovery, 31st March.	Recovery, 29th April.	Recovery, 22nd July.	Total Recovery.
1 ..	4·45	4·13	1·4	0·27	10·25
2 ..	5·00	4·73	2·2	0·40	12·33
3 ..	3·45	2·63	1·4	0·13	7·61

Table 3.—Comparison of Total Yield plus Recovery in Types 1, 2, and 3, arranged according to Blocks.

Block.	Type 1.	Type 2.	Type 3.
A	11·6	12·7	8·8
B	17·8	19·9	12·6
C	14·9	15·9	10·3
Total	44·3	48·5	31·7
Percentage yield..	91·3	100·0	65·3

Summary.

The trials indicate that there are at least three types of rape grown in New Zealand. Type 1 is a large-leaved Giant rape giving a greater initial bulk of feed than the other types, but not the recovery of Type 2.

Type 2 is of a dwarf habit, producing a dense crown of many leaves. Its initial yield is not as great as that of Type 1, but recovery is better.

Type 3 is open in the crown and flat, the leaves bluish-green and much dissected. The initial yield and recovery are very much less than in Types 1 and 2. It runs to seed very early, and present indications are that it is a very undesirable type.

Types 1 and 2 are quite distinct one from the other in appearance. They are possibly equally distinct in feed value and economic adaptation. These points have yet to be proved.

The trade names under which rape is sold in New Zealand are no indication of its type.

Future Work.

(1) Samples of rape, rape kale, and kale are being collected and will be grazed to determine palatability. (2) The same series of samples will be grown to determine type. (3) Replicated blocks of Types 1, 2, and 3 from last year's seed (of which we know the type) will be grown and the yield weighed to determine more accurately the relative yields and recoveries.

Award of Stuart Wilson Cup for 1930-31.—This cup, presented for competition among the boys and girls' agricultural clubs of the Dominion, has been awarded this year to John Cook, a pupil of the Huinga School, in Taranaki, for a crop of carrots yielding at the rate of 75 tons 17 cwt. per acre.

THE FUNCTION OF CYSTINE IN WOOL-PRODUCTION.

O. H. KEYS, M.Sc., Farmers' Union Research Scholar, Massey Agricultural College, Palmerston North.

THE necessity for research into wool problems was never more urgent than at the present time. If wool is to retain its prestige as a textile material a complete understanding of its chemical and physical attributes is most desirable from the point of view of both the producer and the manufacturer. In the following review an attempt is made to indicate in broad outline, for the benefit of wool-growers, the basis of the research work now in progress at the Massey Agricultural College on the biochemistry of the fleece and its production. When this work is correlated with other research being carried out at this college and in other parts of the world, much information of economic and practical importance should result. Up to the present time very little attention has been paid to the *nutrition* of the sheep in relation to the quality of wool. Methods of improving quality have hitherto been based almost entirely upon selective breeding. While this must ever be a first consideration with the farmer, yet the question of feeding is of the utmost importance.

This article deals with a particular aspect of animal nutrition—the role played in wool-production by a substance which has in recent years been brought into the forefront of biochemical investigation.

It has been known for a long time that wool contains a large percentage of sulphur. Recently, however, the fact has emerged that there is a relationship between quality and sulphur content, it having been found from the analyses of a large number of wools that there is less sulphur in hairy medullated wool than in samples of better quality. Work done by the writer in this country shows that this applies to the New Zealand Romney breed; this fact has now been confirmed by Sidey[1]. Sulphur content, therefore, becomes of great importance in the study of the fibre. Sulphur confers upon the wool elasticity, strength, and resistance to decomposition, and this circumstance has been likened to the vulcanization of rubber by the incorporation of sulphur.

Clean scoured wool is composed entirely of a protein, *keratin*. Keratin is also the chief constituent of hair, horns, and hoofs, and is singular among the whole class of proteins in its durability. Of the twenty amino acids which compose all proteins, one of them, *cystine*, occurs in a remarkably high proportion in keratin. Very nearly the whole of the sulphur in wool is present combined in the form of cystine, which occurs there in greater amount than any other amino acid and appears to be the most characteristic constituent. Since the core of medulla, which is present in all hair fibres and represents the main fault in these fibres, appears to contain a lower percentage of sulphur (and hence of cystine) than pure wool keratin, a theory of keratinization has been advanced. It is suggested that if the growing fibre has not received the necessary supply of cystine the cells in the centre fail to become converted into keratin, and are therefore protruded upwards,

and appear as medulla. One may therefore speak of the "cystine stimulus" at the root of the growing fibre; when this is inadequate the wool will suffer either in quality or quantity or in both.

It becomes obvious that the sheep requires a considerable amount of cystine for the growth of wool, in precisely the same way that a contractor must have cement for the production of concrete. In addition, it is possible, as has been pointed out, that the *quality* of the fibre is dependent upon the cystine supply.

Passing reference may here be made to the fact that cystine possesses marked absorptive power for ultra-violet light; its occurrence in large quantities in feathers, animal hairs, wool, and epidermal scales indicates that the evolutionary process has retained this substance as a protection against the toxic rays of the sun.

There is abundant evidence that no animal can manufacture cystine from simpler substances for its own requirements. It must be obtained in a preformed state in the diet. Now, dry wool actually contains, in round figures, 13 per cent. of cystine. That the importance of this study cannot be overestimated is evident when it is realized that the usual pasture plants contain only very small amounts. Indeed Aitken[2], working at Otago University, was unable to demonstrate its presence in grass at all. Yet since every known protein contains cystine, even though it may be present only in minute amounts, and since the sheep is dependent upon the pasture for its cystine supply, it seems probable that the demonstration of its presence in grass merely awaits the development of a suitable analytical technique. Emphasis should be laid on the fact that inorganic sulphur as supplied in licks, &c., cannot take the place of cystine, nor can it be incorporated by the sheep into its growing wool; its role in nutrition is of minor importance and need not be further mentioned in what follows. We are here concerned with the utilization of cystine-sulphur as supplied by the proteins in the diet of the animal.

Causes of Cystine Deficiency in the Wool Fibre.

The failure on the part of a sheep to incorporate sufficient cystine into the growing fibre may be due to a variety of factors, hereditary and environmental. It is desirable briefly to consider these factors separately, although their several effects are probably interrelated in a complex manner. Other agencies of which at present we have no knowledge may also interfere.

(1) *Hereditary Factors.*—Different breeds and different individuals presumably possess in varying degrees the power to supply the optimal quantity of cystine to the fibre as it grows from the follicle. In the Merino, which has been bred for wool for hundreds of years, medulla is conspicuously absent or rare; the Romney, on the other hand, frequently grows a fleece in which coarse hairy fibres abound. Again, within some breeds the tendency to produce medulla varies from one animal to another, due to hereditary differences.

(2) *Seasonal Factors.*—At certain times, when wool is being grown at a fast rate, the "cystine stimulus" may be unable to keep pace with the rapidly growing wool. This statement rests

upon at least two observed facts: (*a*) When a given fleece contains both medullated and non-medullated fibres, the tendency towards medullation is greatest in those which have grown the fastest; (*b*) immediately subsequent to shearing, the sheep is obliged to produce wool rapidly for protection; there is a marked tendency towards medulla-formation at this period of rapid growth. This fact is illustrated by the occurrence of medulla at the tips. Moreover, bands of medullation are frequently found in definite horizons below the tip, suggesting a seasonal effect.

(3) *Quantitative Factors: Inadequate Supply of Cystine.*—This vital factor has been mentioned above. Vegetable proteins are usually poor in cystine content, and, since wool itself contains 13 per cent. of cystine, any failure in the supply of the necessary quantity must affect the fleece adversely. It is not improbable that the proteins of the rapidly growing succulent spring grasses are lower in cystine content than are those of the grasses at other seasons. This would readily explain a tendency towards medulla-formation during the spring period. The capacity of a pasture to produce cystine is probably a determining factor in wool-production.

(4) *Physiological Factors.*—It is reasonable to anticipate that the general health of a sheep will affect its ability to produce the desirable type of fibre. In particular, attempts to correlate growth of wool with the activity of the glands of internal secretion have been singularly successful. More attention has been paid to the activity of the thyroid gland in this connection. Not only do abnormal conditions of the thyroid result in profound changes in the well-being of an animal, but it is also believed that this gland has a specific effect in controlling the growth of wool. This is of especial importance in view of the presence of several goitrous districts in New Zealand. The availability of iodine may therefore be another limiting factor in wool-production. Removal of the thyroid from sheep has caused the growth of a coarse wool which was easily pulled out, and the weight of such a fleece was only two-thirds that of normal control sheep[3]. In another experiment, extending over three years, feeding extra iodine gave an increase in the number of lambs, the live weight of the animals, and the yield of wool. The explanation of these findings is, in the opinion of the writer, that the failure of the thyroid gland to function efficiently probably prevents the animal from utilizing completely the cystine in its diet for wool-production. It must be emphasized, however, that the addition of iodine in the form of iodized licks, &c., is likely to be beneficial only in districts where there is a tendency towards goitrous conditions; moreover, an excess of iodine may produce serious results. The availability of iodine is therefore probably secondary in importance to the availability of cystine.

Physiological Chemistry of Cystine.

The physiological chemistry of cystine may be discussed in two sections, the first comprising the *general* requirements of the animal body and the second the *specific* demands for particular purposes. This distinction is by no means arbitrary, and the two divisions, though closely interrelated, will be considered separately.

(1) *General Requirements.*—Modern biochemical research indicates in a very definite manner that the sulphur atom is responsible for the fundamental chemical reactions taking place in living protoplasm, acting as it does in every single cell of animal and plant tissue as a donor and acceptor of oxygen. Here the sulphur occurs combined as glutathione, which is itself a compound of cystine and glutamic acid. Animals obtain their supplies of amino acids only by the breaking-down of the proteins of their diet. Certain of the amino acids are absolutely indispensable for maintenance and growth; cystine is one of these. Thus, if there is an inadequate supply of cystine in a diet which is otherwise complete, the animal will progressively decline and eventually die, having in the meantime actually utilized some of the proteins of its own tissues to supply the deficiency. The regular ingestion of sufficient cystine is therefore an absolute necessity for the performance of normal physiological functions. As to the actual form in which cystine is absorbed, no definite evidence as yet exists. At this juncture it is worth while to indicate the entrance of another factor which complicates the problem: cystine itself exists in several different forms, but it appears that only one of them (*laevo*-cystine) is capable of being assimilated by animals. The failure to exclude the other forms from cystine preparations has in some cases vitiated, or at least rendered doubtful, the conclusions reached by other workers from its inclusion in artificial diets.

(2) *Specific Requirements.*—Superimposed upon the relatively small quantities indispensable to the normal functioning of the body processes, there are specific requirements of cystine for the elaboration of such keratin structures as horns, hoofs, hair, and wool. In the absence of a plenteous supply of cystine for both general and specific requirements, there arises between the two sets of functions a state of competition, in which there are two possibilities: either the demands of the vital tissues are fulfilled to the detriment of the wool follicles, or the demands for large quantities for wool growth take precedence over the requirements of the body. Here there is a diversity of opinion, but, although the available evidence seems to favour the latter possibility, no definite statement can be made. Several investigators have reported loss of hair in rats fed on cystine-deficient diets, and the addition of cystine to a previously deficient diet has repeatedly produced a heavier and denser coat. In one such case[4] the hair was analysed for its cystine content, which was found actually to have increased. The theory of keratinization outlined above (which, it should be noted, was advanced from separate evidence) is therefore strongly supported by feeding trials. Furthermore, it has recently been shown by a French investigator that prior to keratinization there is an accumulation of sulphur in the tissues of the horse. The writer of the present paper, in examining the roots of plucked wool fibres, has demonstrated the presence of significant quantities of a substance very closely related to cystine. We are therefore at present satisfied with the theory of keratinization and are using it as the basis of the inquiry into the biochemistry of wool-production.

Aim of the Research Work at Massey Agricultural College.

In no previously recorded case have any of these conclusions been applied to the elimination of *medulla* in wool, but this new field is now

being explored at this College. In Australia, it is true, supplementary feeding of sheep under drought conditions with blood-meal (containing about 3 per cent. of cystine) has resulted in a slightly heavier fleece[5]. While this result is decidedly encouraging, the specific action of cystine in increasing the fleece weight was not proved owing to the presence in the supplementary feed of important food constituents other than cystine.

The work now in progress aims at tracing the effect of pure laevo-cystine upon the incidence of medulla, fleece weight, growth-rate, tensile strength, and fibre diameter. In the event of definite results being obtained, investigations will be undertaken into the most economical methods of providing regular and adequate supplies of cystine.

REFERENCES.

(1) SIDEY, *Jour. Textile Institute;* 1931, Vol. 22, p. 370.
(2) AITKEN, *Biochem. Jour.* 1930, Vol. 24, p. 250.
(3) SIMPSON, *Quart. Jour. Exper. Physiol.* 1924, Vol. 14, p. 185.
(4) LIGHTBODY and LEWIS, *Jour. Biological Chem.* 1929, Vol. 82, p. 663.
(5) *Pastoral Review,* 1930, Vol. 40, p. 983 (October).

PERENNIAL RYE-GRASS TRIALS IN CANTERBURY.

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CONSIDERABLE quantities of perennial rye-grass seed from certified areas are now available, and many Canterbury farmers have availed themselves of the opportunity to purchase such seed for sowing in fields where permanancy of pasture is desired.

In order to investigate the position further, and to demonstrate the difference in strain, seven Canterbury versus Hawke's Bay perennial rye-grass trials have been laid down in Canterbury by the Fields Division. These experiments extend to 3 acres of the two types of rye-grass, and in addition there is an area of approximately 3 acres laid down in strains from various parts of the Dominion. The complete experiment in each case is 9 acres, except in the case of the experiment on Mr. L. E. Meyers's farm at Oxford, where a special trial on a 5-acre block was laid down.

The first experiment was laid down on Mr. Meyers's farm at Oxford during October, 1929. This was a trial to ascertain the relative merits of Canterbury and Hawke's Bay rye-grass on a type of soil embracing a large part of the district.

Very dry weather was experienced after sowing, but good rains fell in December and the strike was satisfactory. The Canterbury rye-grass showed the most rapid growth and established with greater rapidity than was the case with the Hawke's Bay rye; but with a recurrence of very dry conditions after the middle of January the apparent superiority in growth of the Canterbury type was of short duration, and by the end of March it was practically dormant, and remained in this condition until September.

It was noticeable that as the colder weather approached the Canterbury rye-grass produced less and less leafage. The Hawke's Bay rye had established well and produced a considerable amount of leafage throughout the winter, and as spring approached the area took on a fresh appearance generally. The Canterbury rye still showed no sign of growth. Early in August sods were taken from both the Canterbury and the Hawke's Bay blocks for demonstration purposes at the Christchurch winter show, and were objects of interest to all farmers visiting the Agriculture Department's exhibit. Those farmers who were acquainted with the area fully appreciated the difference in the two types of rye-grass.

It is stated above that the Canterbury rye-grass had been dormant, but that does not now fully explain the position. At the time of writing (September) 90 per cent. of the plants show only a weak growth, irrespective of manuring, and are past their period of usefulness, as they are not now capable of affording any quantity of feed. This state of affairs has no doubt been hastened by the intensive management of the area, which did not afford the plants the opportunity of reseeding that normally takes place in Canterbury pastures under ordinary conditions of management, and which to some extent prolongs the period of usefulness of the sward. With the decreased competition of the rye-grass on the Canterbury area at Meyers's farm bare spaces became more pronounced, and the clover content increased considerably and provided the bulk of the feed. This factor is important and will be studied further in the later trials.

To sum up the situation at the Oxford trial, it can be stated definitely that the Hawke's Bay type of rye-grass will hold for a longer period and will stand up to adverse weather conditions better than the ordinary Canterbury rye-grass. The result of the trial brought out various points which necessitated more elaborate and searching experiments, and these have since been laid down in various other districts.

Canterbury versus Hawke's Bay Grazing Trials.

With the evident difference in palatability in the two types of rye-grass, further experiments were found necessary. An experiment was designed by the Crop Experimentalist in an endeavour to clear up various points such as permanency, palatability, production, and recovery after grazing.

The conditions were as follows: An area of 9 acres of a uniform field was fenced off into three fields of 3 acres each. The first, Field A, was sown with a permanent mixture containing 25 lb. Hawke's Bay rye-grass, 12 lb. Akaroa cocksfoot, 2 lb. Poa trivialis, 2 lb. N.Z. white clover, 2 lb. N.Z. red clover, and 3 lb. crested dogstail. The second, Field B, was sown with a similar mixture, but Canterbury rye-grass was substituted for the Hawke's Bay type. In the case of Field A thirty-two lines of the Hawke's Bay seed were blended to secure the sample, while in the case of Field B twenty lines of Canterbury seed were used in the mixture. The third, Field C, was sown with fifty duplicate plots containing various strains of rye-grass, cocksfoot, and clovers from different localities in New Zealand and elsewhere.

As the scheme was not perfected until March, 1930, only two experiments could be arranged for that season. The trial at Mr. I. K. Buchanan's Meadowbank Estate, Irwell, being the first to be laid down, will be dealt with here.

The area selected was part of an 18-acre field of good clay loam overlying a clay subsoil, and had been fallowed since the spring. Each field was pegged out and the seed sown broadcast on a well-rolled surface with a mixture of two parts of superphosphate to one part of sulphate of ammonia, sown at the rate of 2 cwt. per acre. After sowing, the whole was lightly harrowed. The headlands of Field C were sown in a similar manner, but the small plots were sown by hand.

Fields A and B were sown on 30th March, 1930, under very dry conditions, which persisted throughout April. The soil, however, was in good condition and had been well prepared, and was able to some extent to withstand the effects of drought. By the beginning of May there was evidence of a fair strike of rye-grass on both fields. The Canterbury type had germinated more rapidly and had made better growth than the Hawke's Bay type. Throughout the winter both established well, but as spring advanced the more prolific growth of the Canterbury rye was very much in evidence.

The grazing of the fields was carried out on the intensive system —that is, the grass was allowed to grow to a suitable length for grazing with whatever kind of stock was being used, and then grazed off quickly and allowed to recover. In order to obtain control a large number of stock were used, the fields being stocked at the rate of 20 to 40 sheep per acre. By September the Canterbury area was ready for the first grazing, some two weeks before the Hawke's Bay area. However, grazing could not be carried out owing to wet weather. When the field was sufficiently dry to carry stock, grazing was commenced, but was interrupted by rain before complete control was obtained. After the first grazing and subsequent consolidation, grazing could be carried out regardless of weather conditions. The grazing of these two fields at Irwell was extremely well carried out during the past season, and the results obtained can confidently be taken as a true estimate of the values in the first season of the two types of rye-grass under the conditions prevailing in that particular district.

From various observations of the Canterbury area we have reason to believe that the type of rye-grass sown was better than the average, and distinctly better as a grazing proposition than the usual type used.

Owing to the first grazing of the Canterbury rye-grass being interrupted by wet weather, the grazings for the first six months under consideration will be better shown in two-monthly periods. In September and October (1930) the Canterbury field carried 12·45 sheep per acre, compared with 10·5 sheep carried by the Hawke's Bay rye-grass. In November and December the Canterbury rye carried 10·2 sheep per acre while the Hawke's Bay rye carried 9·6 sheep. In January and February the Canterbury fell to 3·9 sheep per acre, while the Hawke's Bay carried 8·9 sheep per acre.

These figures tend to show that the poor types of rye-grass give a big flush of feed in the early period of their growth, but production rapidly falls away until the pastures reach the " run-out " stage in varying periods of from twelve months onward. Both fields fell in

carrying-capacity, but this was to be expected owing to the season of the year. The January and February period is usually dry with little growth. Taking this into consideration, it is most satisfactory to note how little the Hawke's Bay rye-grass fell in carrying-capacity. It confirms the contention that under controlled grazing good types of rye have little, if any, actual dormant period.

At Irwell the growth on both fields was well controlled; consequently, when the usual dry conditions and north-westers came in January and February, both pastures suffered considerably more than would have been the case had more foliage been allowed to remain. Large cracks appeared, and there was an abnormal drying-out of the soil. This condition prevented the establishment of the clovers and the development of the rye-grass. From these observations one is led to the conclusion that during the dry months close grazing in Canterbury would have to be practised on thoroughly established pastures only.

At the time of writing the fields are most interesting. On the Hawke's Bay area plants are in healthy growing-condition, while on the Canterbury area many plants are dead and bare spaces in the pasture are prominent. Present indications are that the Hawke's Bay area will form a good pasture, while the other area will be practically in a run-out condition next season.

General.

In the strains and species area the plots are of one-fiftieth of an acre in area, laid down in duplicate, and consist of various strains of perennial rye-grass obtained from different parts of the Dominion. The trial shows that in nearly all cases the South Island strains are of a poor type and unsuitable for permanent pastures. The Hawke's Bay and Sandon ryes are on the whole very good, and have produced a certain amount of growth throughout the long period of dry weather experienced during the past season.

In order to further investigate the perennial rye-grass position in Canterbury, five other trials have been laid down on the farms of A. R. Hislop, Amberley; G. Hall, Hororata; H. Wright Johnston, Dunsandel; Hunter Morris, Winchmore; and W. L. Hay, Waimate. These trials will be reported on when sufficient data are available. Each of the farmers concerned has lent his hearty assistance to the investigation, and have controlled the various fields in an excellent manner.

Importation of Live-stock.—The prohibition imposed on cattle, sheep, and swine from Britain as a precaution against the entry of foot-and-mouth disease still exists, and the only countries from which stock may be imported subject to the regulations are: Cattle from Tasmania, Canada, and the United States (with the exception of California), and swine from Australia (with the exception of Queensland and Western Australia), and Canada, and sheep from Australia (with the exception of Queensland and Western Australia). A prominent feature during the official year ended 31st March last was the heavy importation of pedigree cattle in comparison with former years. The following imported animals were placed in quarantine during the year for the respective periods required: Horses, 7; cattle, 87; sheep, 9; swine, 10; dogs, 27.

RECENT WORK ON IRON-STARVATION IN OTHER COUNTRIES.

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Two important publications which bear directly on the "bush sickness" malnutrition disease in ruminants have come recently to hand, and confirm the opinion that the trouble is not confined to New Zealand, but occurs on soils of coarse texture in the volcanic-ash country of Kenya Colony and on the non-volcanic sandy soils of Florida, U.S.A. There is little doubt that both diseases are identical with bush sickness.

Dr. J. B. Orr, Director of the Rowett Research Institute, Aberdeen, and Mr. Alexander Holm, Director of Agriculture in Kenya, in the Sixth Annual Report of the Committee on the Mineral Content of Natural Pastures to the Economic Advisory Council (H.M. Stationery Office, London, 1931, 1s.) describe the symptoms and surrounding conditions of "nakuruitis," a wasting disease in cattle called after the name of the district Nakuru, in Kenya Colony, where there is a well-defined area in which cattle do not thrive, a fact first noticed in 1914. The top-soil of this country consists of material which has been erupted from the adjoining extinct Menengai volcano.

The veterinary officers of Nairobi, British East Africa, in 1918 brought under this Department's notice the occurrence of this peculiar condition affecting sheep and cattle when grazed on volcanic soils in that Protectorate similar to, if not identical with, they thought, "bush sickness" as described in the New Zealand reports. They found that the disease could not be communicated to healthy animals by transfusion of blood experiments, there was no indication of the cause of death, and no parasites were seen, advanced anæmia being the only symptom discoverable on *post mortem* examination. Affected animals when transferred to other country known to be healthy recovered, and no cases had been recorded among horses. It was also reported that the general opinion among farmers was that the disease occurred only on soils of volcanic origin, the affected animals recovering on being moved to non-volcanic soils, and that cases never occurred on red soil (redness in soil is always due to iron oxides). The disease seemed to be well known by the Native population in the Masai Reserve.

Orr and Holm, after referring to the New Zealand work and the theory that bush sickness was due to a lack of iron in the pasture, give in the above-mentioned publication a precise account of the experiments they undertook with a number of oxen (124) which, except a control group of thirty-one, were allowed access to different salt-licks, all of which contained iron oxide in varying proportions. It may be briefly stated that these experiments lasted from November, 1926, until October, 1927, at which date all the control animals still living which had received no iron lick and that group which only received a small amount of iron lick were so weak and emaciated that it would have been difficult to save the lives of any of them. The group of cattle having received an intermediate quantity of iron were intermediate in condition and weight between those which received a smaller amount and those which received a large amount. Those which received the highest

amount of iron were in the best condition and weight, being an exceptionally fat and healthy lot. These authors therefore conclude that the feeding of salt and iron oxide prevented the onset of this disease, and was found to effect a cure in cases which were not too far advanced.

Reports have since been received that this method of prevention has been applied on several farms and has been found successful, oxen having been kept in good condition for at least a year, whereas, without the use of this simple salt-lick, it was impossible to keep them in good condition for longer than six months without changing them to another district. This result, say the authors, should be regarded as confirmation of the valuable results obtained in New Zealand as the result of many years' laborious research on a disease known as "bush sickness" which appears to be of the same nature as "nakuruitis."

Bulletin 231 of the University of Florida Agriculture Experiment Station, Gainseville, Florida, published in June, 1931, contains an account of "salt sick," which the authors, Drs. Becker, Neal, and Shealy, say is an age-old problem with Florida cattle-grazing, on certain types of soils both on the range and in fenced areas. It is the greatest single cause of loss to the cattle industry in the State because of the greatly reduced calf-crop, retarded growth, and reduced beef yields per acre. Many animals die of the condition. Changing cattle back and forth from "salt sick" to "healthy" ranges lowers efficiency and utilization of the forages. On large areas cattle are no longer raised because "they just won't live on this land."

Although investigation work had been going on in Florida at this Station for over forty years, the experts do not seem to have got on the track of the cause until recently. The authors say investigation of "salt sick" at the Florida Station has proved this condition to be a naturally occurring nutritional anæmia in cattle the feed of which has been restricted largely to grass forages grown on certain white and grey sandy soils, and residual muck and peaty soils not subject to overflow from more fertile watersheds. It was found that forage plants grown on these soils contain less of iron, or of iron and copper, than those from more fertile areas. When affected cattle were given iron and traces of copper to supplement these forages the condition was overcome in all but most advanced cases.

A number of illuminating photographs in the bulletin show cattle with the characteristic appearance of that known here as "bush sickness." A cow treated daily with 3 oz. of a 6-per-cent. solution of ferric ammonium citrate as a drench recovered fully, and the blood from containing only one-third the normal amount of red pigment returned under the treatment to that of normal composition. For range cattle the bulletin recommends a lick containing salt, iron oxide, and a little copper sulphate. In advanced cases, the authors advise the New Zealand treatment of ferric ammonium citrate to which an amount of copper sulphate* has been added. They promise further details about this interesting condition in cattle in the next technical bulletin on the subject issued by the Station.

* Copper is not required in New Zealand "bush-sick" districts, where it exists in plants in the soil and herbage in adequate amounts.

An interesting statement of the bulletin under notice that swine are affected with "salt sick" in common with the ruminating animals—cattle, sheep, and goats—if proved to be correct will help to strengthen the opinion that bush sickness is a pure deficiency disease. There has always hitherto been a suspicion that bush sickness was confined to ruminants and due in some way to the difference in the digestive system of this class of animal compared with that of other classes, but if swine are susceptible it will do much to support the iron theory and rationalize the treatment. Swine are known to be particularly susceptible to conditions favouring anæmia, but eat copiously of iron-containing substances when allowed, such as earth, cinders, rock, &c., and so may better cope with any deficiency in the pasture.

These researches emphasize the fact that other countries are taking advantage of original work done in New Zealand and are adapting the treatment of ruminants in deficiency areas to accord with the new knowledge, also with the expenditure of a very small outlay—a few pence annually per head of stock—are farming large tracts of land which have in the case of Florida presented, as the Americans phrase it, an age-old problem. It must also be remembered that in the Cheviot Hills, between England and Scotland, sheep-farming presented the same problem as it does in our bush-sick areas, and that the disease there known as "pining" excited the interest of the poet Hogg ("The Ettrick Shepherd") so long ago as 1807, when he accurately described the symptoms which are exactly those of bush sickness in sheep. There is reason to believe that iron starvation in ruminants is not confined to soils derived from acid volcanic rock, but may be found in any sandy soils or soils abnormally coarse in texture where animals cannot benefit by a change to finer soil on the same farm.

The New Zealand investigation did not last so long as that in Florida (forty years), since it was only started in 1900 and the first evidence that deficient iron was the cause was published some twelve years later (this *Journal*, August, 1912, p. 124). The New Zealand farmer has, however, paid in more ways than one for the knowledge gained in the treatment of bush sickness during the past twenty years, and he should be the first to profit by the discoveries made in New Zealand. Either the carbonate of iron or the hydroxide of iron in ground condition suitable for making into a stock lick is now on sale at the Rotorua office of this Department, and the farmer only requires to purchase elsewhere the salt to mix with the iron, the total cost of this treatment only being a few pence per animal yearly. Either the hydroxide or the carbonate has proved to be particularly suitable for making a lick for sheep, for which the citrate is not so suitable. The advantage of the hydroxide and the finely-ground carbonate of iron when used mixed with salt as a stock-lick is that sheep are found to take these forms of iron, while they generally refuse to take the citrate of iron and ammonium under the same conditions.

NOTE.—Where large quantities of the hydroxide are required the charge for ½-ton lots and over will be 5s. 6d. per hundredweight, and for lesser quantities 6s. per hundredweight, plus, in each case, the freight from Ruatangata, which must be paid in advance when consigned to flag stations.

FACTORS INFLUENCING THE KEEPING-QUALITIES OF PEARS IN COOL STORAGE.

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PRE-STORAGE FACTORS.

CLIMATIC conditions prevailing from year to year during the maturing stages of fruit exert considerable influence on its keeping-qualities. Pears grown in districts with relatively high temperatures and low humidities possess the best storage and keeping-qualities, while, if the atmosphere is too moist, the length of the storage life of the product is attended with uncertainty, irrespective of whether the fruit is produced on poor or on more fertile soil.

It is recognized that moisture in the atmosphere is essential when pears are swelling (and when heat vapour is considerable they increase in size rapidly) because the swelling is not due to the moisture supplied by the roots alone; no matter how ample the latter supply may be the growth of the fruit will be much slower, and the fruit will not be as large in size as when climatic conditions exist which promote vigorous growth, or when both the soil and atmosphere are heavily charged with moisture. More water, both at the roots and in the atmosphere, is needed during the swelling stage than subsequently when the fruit is near maturity.

With regard to pears for cool storage, there is much to be said about climatic conditions during the maturing stages of the fruit, the most favourable being those conditions which promote a constant growth throughout the season without the product being subjected to any check owing to excessively dry weather, and then being suddenly forced by large quantities of moisture both at the roots and in the atmosphere. The latter condition renders the fruit more susceptible to physiological diseases and fungal attack.

In seasons when a steady growth of the fruit takes place, large quantities of food reserves are stored and a lesser quantity of living matter, while during seasons which promote vigorous growth a larger quantity of living matter and a small quantity of food reserves are stored, thus reducing the storage life of the fruit. The larger the quantity of food reserves stored up by the fruit during the growing season the longer will be the life of the product.

Chemical changes occur during the maturing stages of fruit, such as the conversion of mucilage and starch into saccharine matter by the action of heat and acids; these changes continue with the ripening process in most fruits after they are gathered when the heat is sufficient to incite fermentation. However, their ripening may be facilitated or retarded by a regulation of temperature. For the production of prime pears of good keeping-quality a dry buoyant atmosphere during the maturing stages is requisite. An excess of moisture, both at the roots and in the air, during the maturing stages has often been the chief but unsuspected cause of wastage in cool-stored pears.

Gathering and Handling the Crop for Storage.

Picking maturity is influenced by climatic conditions, which vary from season to season, not only in centres distant from one another, but in different localities in the same district, which makes it difficult to lay down specific calendar dates for gathering pears. The general tendency is to pick many varieties at different stages of maturity and several varieties far too early, sacrificing quality, flavour, and appearance, which ultimately reduce the market value of the fruit.

The necessity for careful picking, packing, and handling of pears cannot be overstressed. If wastage in cool-stored pears is to be reduced to a minimum they should be handled and examined with care equal to that taken with eggs, more particularly as damage to the fruit during picking is frequently of such a nature as to escape notice unless each individual fruit is carefully scrutinized.

It means a little more trouble and expense to select pears for cool storage in order to be sure that every specimen is clean and free from injury, rejecting those which show the slightest injury or defect, and also those fruits that have a gummy feeling, which indicates that the fruit is bleeding or the juice permeating the skin. Fruitgrowers may not think that they are justified in rejecting specimens with a slight injury. However, it is just these pears, which, when distributed through a large consignment and placed in cool storage, are often responsible for increasing the amount of wastage tenfold. This wastage is generally attributed to cool-storage conditions, when really it is due to pre-storage factors.

Cool-store Hygiene.

If a cool store is well built, well insulated, and equipped with an efficient and suitable refrigerating-plant, the first question which must receive attention is the cleanliness of the establishment in which fruit is to be stored, as this factor is of equal importance to that of others where foodstuffs are stored, manufactured, or prepared for human consumption.

A fruit cool store can be considered as being a large insulated box divided into several compartments and equipped with a refrigerating-plant. The piping through which the refrigerant is circulated is either attached to the walls and roof of the chambers or in a special room adjacent to them. In the latter case the refrigeration is distributed by means of a fan which circulates the cold air through the rooms.

In the application of refrigeration to the cooling of foodstuffs absolutely nothing is added to the atmosphere or the product to be preserved; neither is the process responsible for the accumulation of foreign matter inside or outside the compartments. Therefore the cleanliness of the establishment is under the direct control of the management, which should maintain the interior of the cool rooms, packing-rooms, and benches, together with the outside of the building, in a scrupulously clean condition, preventing any deposits on the floors or walls of the compartments, and should also pay special attention to the removal of decayed or waste fruit from any section of the plant and its surroundings.

Uniformity in Cooling.

In addition to retarding the ripening process, refrigeration is equally important in checking any tendency towards decay. There are several systems by which mechanical refrigeration is applied to fruit cool stores, but, no matter what method is employed, the fact remains that cooling must be uniform. Considerable importance attaches to the stowage of pears in the cool chambers, as all previous good work can be undone by close stowage. One of the main factors in pear storage is uniform stowage with ample air space between the containers, in order to facilitate rapid initial cooling and the maintenance of relatively low and uniform temperatures throughout the storage period. The fruit should reach the cool store with the least possible delay after gathering, as the storage life of the product will be shortened in proportion to the time that elapses between picking and the ultimate reduction of the fruit to the required temperature.

Too much stress cannot be laid upon the point of inducing a circulation about the individual fruits, keeping them in mind as a unit rather than the case or container. If the heat must be conducted from fruit to fruit outwards, and at the surface of the package absorbed by the passing air, the process is a tedious one. However, when conduction is supplemented by convection it aids in materially lessening the time of cooling.

The factor of uneven cooling has often been responsible for considerable wastage in pears. A method practised to advantage is that of pre-cooling the fruit in a separate compartment or placing the packed containers loosely on the floor of the chamber and allowing them to cool out before stowing them in the main stacks.

Cool-storage Temperatures.

For the preservation of pears by cool storage a relatively low temperature is required, the range of which is not very great. The most successful temperature is 29° to 32° F., the latter being the maximum rise throughout the storage period. However, care must be exercised just where and how these temperatures are obtained, as no reliable temperature can be obtained by hanging a thermometer on the outside of a large stack, or inserting it into the flesh of the fruit and placing it in a position where it is exposed to the cold air. These practices are misleading, as the fruit on the outside of a stack or a single pear in an exposed position is reduced in temperature rapidly, while the fruit in the centre of the stacks will take days or possibly weeks if the temperatures recorded by the thermometers in the positions referred to above are regarded as an index of the temperatures of the main bulk. Further, during the loading of warm fruit, a thermometer inserted into a single fruit and placed on the outside of the main stack will not record either the variation in the temperature of the chamber or that of the fruit in the stacks. Therefore it is essential that the thermometers be placed in accessible positions throughout the main bulk, where the maximum and minimum temperatures of the storage-rooms and fruit can be ascertained, thus enabling the operator to regulate the refrigeration by an adjustment of the valves or shutters, according to the temperatures of the storage-rooms.

Humidity.

The factor of humidity plays an important part in the preservation of pears by refrigeration, and, while the subject has been discussed widely, very little has been done in investigating this matter. At the present time it is difficult to lay down any hard-and-fast rule regarding the humidity ratio of the atmosphere in a fruit cool store, since this depends on many factors which have to be known and carefully studied. Temperatures and frequency and method of ventilation are factors; then, again, climatic conditions during the production of the fruit and those existing during harvesting have an influence. The class of container is also a factor which influences the relative humidity of a cool-store chamber. If the wood with which the containers are made has been seasoned and is perfectly dry it has a tendency to absorb moisture, often resulting in the fruit becoming wilted. On the other hand, if the package is of a damp nature and the conditions in the compartment are favourable, fungal rots may occur. While a relative humidity of 83 to 85 per cent. may be suitable, this may have to be varied according to the conditions referred to above.

Causes of Wastage.

Overripening: Due to high temperatures, bad distribution of refrigeration, and uneven cooling.

Wilting: Caused by immaturity, high temperatures, and low relative humidity.

Scald: Due to immaturity and susceptible varieties—Beurré Clairgeau, Beurré Capiaumont, and Vicar of Winkfield being among the latter.

Fungal rots in nests: Caused principally by damaged or bleeding fruits, which, when they are attacked by fungi, develop rots which spread and affect all fruit with which they come in contact. This wastage is increased by bad storage conditions.

Very rarely does this last class of wastage come under notice until late in the season, when the grower commences to remove his fruit from store for market. He is then at a loss to understand how these nests of pears affected with fungal rots have occurred, and is generally sure in his own mind that the large number of affected fruits in the nests could not have been damaged before storage. However, this wastage may have been caused by one fruit in the case, and it would be a big contract to examine all the fruit and remove those affected to prevent further wastage. Thus the only effective measure that can be employed is to take all precautions and see that every fruit is in perfect condition before being placed in storage.

Trials with Timothy Grass.—The Agrostologist, Plant Research Station, remarks on this species in his report for 1930–31 as follows: "Twenty-six lines are under trial, sown in the autumn of 1930, from Germany, Scotland, Sweden, Norway, Russia, United States of America, Aberystwyth, and New Zealand. There is some fairly marked variation, but the grass as a whole has given very disappointing results in our trial grounds. For New Zealand conditions, excepting perhaps in country too wet for rye-grass, I am of the opinion that the value of timothy is overrated."

ASHBURTON EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1930–31.*

R. McGILLIVRAY, Fields Superintendent, and J. G. McKAY, Fields Instructor, Christchurch.

CLIMATIC conditions in Mid-Canterbury during the season of 1930–31 were unfavourable from the agricultural viewpoint. The winter and spring were cold and dry; frequent north-west winds were experienced during the summer, and there was an extreme drying-out of the soil. The cereal crops came away well, but continuous hot, dry weather during the later period of growth resulted in some very pinched grain samples. Rain which fell late in January resulted in second growth in the potato crops.

WORK ON POTATOES.

Selection work similar to that dealt with in last season's report (*Journal*, July, 1930) was carried out, the standard of the various varieties being maintained or improved by vigorous roguing for virus disease and the planting of selected tubers. Selections were made from all varieties grown at the farm, and some selections were also made from farmers' lines. Precautions were taken to prevent the spread of disease, and for this purpose belts of oats were grown to isolate the tuber unit selections, and where this was done, complete isolation was obtained.

From an area planted out to pure lines of potatoes, a quantity of seed of the following varieties has been made available for distribution to growers: Abundance, Ally, Arran Banner, Arran Consul, Arran Victory, Aucklander Short-top, Aucklander Tall-top, British Queen, Champion, Duke of York, Epicure, Field Marshal, Golden Wonder, Great Scott, Herald, Kerr's Pink, King Edward, Majestic, Sharpe's Express. This material was particularly good and met with a ready sale. Some varieties were sold out soon after being made available to farmers.

All lines were entered for certification last season, and can thus be compared with seed being handled commercially. The varieties which were outstanding in yield were Up-to-Date, Field Marshal, and Arran Banner, the latter being the best of the newer imported varieties.

The following imported varieties were also grown: Di Vernon, May Queen, Champion, Eclipse. These will be entered for certification this season so as to ascertain their cropping-power.

Of the varieties Burbank, Dooley, Green Mountain, and Irish Cobbler, imported from Canada last season, the last named yielded the best this season. Burbank yielded well, but second growth was

* This will be the last of the periodical reports on the Ashburton Experimental Farm in the *Journal*. The farm area, which has been held on lease by the Department of Agriculture from the Ashburton High School Board for the past fifteen years, was vacated by the Department at the end of June last. A large part of the work conducted at Ashburton has been transferred to an area recently established on the Canterbury Agricultural College farm, Lincoln. This area will be known as the Government Pure Seed Station.—EDITOR.

bad, and the variety appears to be susceptible to blight. With the exception of Green Mountain, there will probably be sufficient seed available to place these varieties in a qualifying trial this season.

CERTIFICATION.

There was a considerable increase in the number of entries under the potato-certification scheme as compared with the previous season, and in order to reduce the amount of inspection work as much as possible it was decided to divide the entries into two classes. Only those lines certified or provisionally certified in the previous season were made eligible for certification, and one hundred tubers from each of these lines were planted in the Ashburton trials. Lines not previously certified were grown in a qualifying trial to ascertain their suitability from a certification point of view. In this latter trial fifty sets only were planted. Planting was carried out under favourable conditions and early growth was satisfactory. However, the land where these trials were carried out was too light to withstand the dry conditions that prevailed; the crop when dug proved one of the lightest ever grown on the farm, and the stunted growth of the plants made detection of virus disease very difficult.

In order to give farmers and others interested more time to study the various phases of the work being carried out, and to afford growers an opportunity of more closely studying their lines of potatoes in competition with others entered in certification, arrangements were made for visitors from North, Mid, and South Canterbury to visit the farm on three separate days. This arrangement proved satisfactory, and visitors showed keen interest in the various trials that were being conducted.

In comparing the areas of potatoes entered for certification during the past two seasons it is interesting to note that of 1,231 acres entered in 1929–30 only 427 passed the field inspection, whereas in 1930–31 out of a total of 1,454 acres entered 1,038 acres were passed. It will thus be seen that rejections in the field this last season were comparatively small. Certainly all of these lines were in certification last season, but as there has been a slight tightening up in the standard set for virus diseases, &c., the above figures may be regarded as an indication that most of the growers concerned are alive to the necessity of roguing for virus diseases, &c.

ORIGIN OF SEED TRIALS.

The trial of Ashburton-grown versus Southland-grown Arran Chief potatoes was carried into the third season. Trials were planted

Line.	Table Potatoes.		Seed Potatoes.		Total Increase.
	Yield.	Increase over Ashburton.	Yield.	Increase over Ashburton.	
	Tons.	Tons.	Tons.	Tons.	Tons.
A ..	2·7	..	3·4	..	..
B ..	3·3	0·6	3·8	0·4	1·0
C ..	3·6	0·9	4·2	0·8	1·7
D ..	3·2	0·5	3·9	0·5	1·0

with the following lines: (A) Ashburton seed; (B) Ashburton seed once grown in Southland; (C) Ashburton seed twice grown in Southland; (D) Ashburton seed grown three seasons in Southland. The results of the trials are shown in the accompanying table.

Wheat-selection Work.

As a result of the natural cross-fertilization which occurred between wheat varieties on the farm in 1928–29, it was necessary last season to make further selections from all varieties grown. Ear to row trials were again sown. These were carefully observed during growth, and any lines showing undesirable characteristics discarded. Small yield-trials were sown by hand, with controls every third plot and the whole repeated eight times. The seed for this trial was hot-water treated before sowing, which unfortunately reduced the germination to such an extent as to render the trial valueless.

Larger yield-trials were carried out with selections from Solid-straw Tuscan, Dreadnought, Hunter's, Velvet Chaff, Pearl, and White-straw Tuscan. The plots were sown with a hand-drill, and consisted of rows 45 in. long by 14 in. apart. Controls were sown every third plot, and the whole trial repeated ten times. The soil where this trial was carried out was fairly uniform, and this fact, together with an increase in the number of replications over last season, gave greater accuracy to the results and made it possible to eliminate a number of the poorer-yielding strains. Increase plots of all varieties were sown with rye-corn between each two to prevent cross-fertilization so far as possible.

An area of 7 acres was sown to Velvet Chaff, Dreadnought, and Solid-straw Tuscan. The Velvet and Dreadnought were the best-yielding strains of these two varieties tested at Ashburton in the previous season, and the Solid-straw Tuscan was supplied from Lincoln College. These crops, which followed potatoes, were sown at the rate of 1½ bushels per acre, with 1 cwt. of superphosphate, and buffer strips of rye-corn between each two. All varieties made splendid early growth and promised to yield exceptionally well, but weather conditions were so unfavourable when they were filling that the samples were very pinched.

The efficacy of rye-corn when grown as a buffer in preventing cross-fertilization of wheats has not yet been definitely determined, but by reason of its tall vigorous growth it certainly appears to have possibilities in this direction.

Varieties of wheat grown under ordinary field conditions to provide seed for variety trials were: Dreadnought, Dreadnought 5/27, Victor, Marquis O 1/97/13, Solid-straw Velvet, Reward, Marquis 10B, Yeoman, Bell's Hunter's, White Fife, Garnet, Velvet Chaff, Major, Solid-straw Tuscan.

Malting Barley.

In the 1929–30 season a number of selections raised from single ears were grown for increasing and for observation on trueness to type. All lines within a variety were so even that no selection could be done that season. In the season under review a small yield trial was planned

and sown in September with four selections each of Plumage, Plumage Archer, Chevalier, Archer, and Spratt, also with one selection of Goldthorpe Spratt. The seed was sown by hand in rows 12 in. apart and seeds placed 3 in. apart in the rows. Controls of a bulk line of Plumage Archer were sown every third row, and the whole trial was repeated eight times. Germination, although fairly even, was slow, and growth was poor. Results were indefinite, and it will be necessary to repeat the trial during another season.

Lucerne.

A 20-acre paddock of lucerne sown in 1921 is still flourishing. Besides giving a cut of hay, the lucerne provided a large amount of grazing for sheep during the season despite the dry weather conditions. The effects of superphosphate applied in 1924 to certain parts of the area were still apparent. This was particularly noticeable where the lucerne is in wide rows and where no marked response was apparent in the first two seasons following the application of the fertilizer.

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1930–31.

W. J. McCulloch, Fields Superintendent, Palmerston North.

Grassland work again claimed sole attention on the Marton Experimental Area during the season of 1930–31, the operations in the main being a continuation of work previously initiated. From a pasture point of view the season was not ideal, owing to the slow rate of growth in the spring, and this condition continued well into December. A fine autumn and early winter were followed by a wet, cold spring, with more than the usual amount of wind and a lack of sunshine. From December onwards the weather steadily improved, and in consequence growth came on rapidly.

Rye-grass Strain Trials.

These trials, which were laid down in the autumn of 1929 under the care of Mr. E. Bruce Levy, Agrostologist, comprise some 620 plots of the various strains usually found on the market under the name of perennial rye-grass, many of which are pseudo or false types and non-persistent in habit.

The differences in vegetative covering of the various plots during the spring and summer of 1930–31 were remarkable, and could not fail to impress the most casual observer with the great value of the well-known strain of Hawke's Bay rye. On the other hand, many of the false perennial strains had completely disappeared, while others, according to their degree of persistency, were declining fast. Although no white clover was sown in these plots, a surprisingly large amount of volunteer white manifested itself as the non-persistent strains of rye-grass disappeared, and in consequence clearly defined those plots. The persistent Hawke's Bay strain has rapidly built up into a vigorous sward, completely dominating the surface.

Fertilizers were applied as follows: 3 cwt. superphosphate per acre at time of sowing on 4th April, 1929, followed by 3 cwt. super plus 1 cwt. sulphate of ammonia on 28th August, 1929. It thus seems to be clearly demonstrated that top-dressing is not a controlling factor in the persistency of rye-grass unless the strain is of the right type; and it will readily be realized that as a result of manuring the development of volunteer white clover took place, instead of inferior grasses and flat weeds, in plots originally occupied by the non-persistent strains of rye-grass.

The foregoing are an elaboration of simpler trials of rye-grass types, some of which have been in existence on this area during the last four years, comprising sowings of Hawke's Bay, Sandon, and standard Canterbury strains of rye-grass, and throughout that period these have demonstrated the distinct persistency and value of the Hawke's Bay strain.

Pasture Top-dressing Experiments.

As in previous seasons, green-hay weights were taken on the various top-dressed plots of Moss's, Brice's, and Follett's sections. This work, as well as demonstrating the varied effect from the application of different manures over a period of years, has served to illustrate in a practical manner that a maximum return for expenditure on manures cannot be expected on this type of pasture, which was originally composed mainly of brown-top and sweet vernal.

The chief development in sward composition has been in respect to the clover and trefoil content, and to a much lesser degree of crested dogstail, but such grasses as rye, cocksfoot, &c., so necessary in a high-class pasture, were apparently not sufficiently represented in the sward when top-dressing was initiated. As a result, the natural conclusion arrived at is that where practicable worn-out pasture should be renewed and thereafter maintained at the required standard by top-dressing, rather than attempting the extremely slow and often uneconomical development of a worn-out pasture.

Apart from these economic considerations, interesting information on the behaviour of the various manures is being accumulated from year to year. In order to ascertain the residual effects of the various fertilizers, none of the plots (with exception of Plot No. 0 in Moss's section) received a dressing in 1930. The accompanying tables of results of weighings in 1930 bring the information up to date.

Moss's Section (Table 1).

A striking feature in regard to this year's results is the marked decline in every instance where superphosphate has been used, either alone or in combination, as a result of no applications in 1930, whereas Nauru appears to have shown a slight increase. The yields from basic super and slag have remained constant, indicating that sufficient residue remained from previous applications to carry over the 1930 season. There is evidence, therefore, that in order to maintain fertility at a fixed standard with super it must be applied regularly, while on the other hand if for any reason the slower-acting phosphates such as Nauru, &c., are not applied regularly, as the residual effect is greater they are capable of carrying on for a time.

Table 1.—Moss's Section (Field 4A).

Plot No.	Treatment per Acre.	Green Weight per Acre —One Cut, 1930. Average of Five Manured Plots.	Green Weight per Acre —One Cut, 1930. Average of Five Controls.	Percentage Increase.	Green Weight per Acre — One Cut, 1929.	Total Green Weight per Acre — One Cut Annually, Six Years.
		Tons.	Tons.		Tons.	Tons.
0	Carbonate of lime, ½ ton, 27/7/25, 15/8/29; super, 3 cwt., 5/8/30	3·2	1·6	100	2·2	10·98
1	Carbonate of lime, ½ ton, 27/7/25, 15/8/29	1·17	1·6	Loss, 27	2·2	8·95
2	Carbonate of lime, ½ ton, 27/7/25; super, 3 cwt., 27/7/25, 28/5/26, 23/7/28, 15/8/29	4·4	1·7	Increase, 159	6·3	26·33
3	Super, 3 cwt. (Dates applied as for Plot 2)	4·8	1·8	167	6·7	26·53
4	Basic super, 3 cwt. (Dates applied as for Plot 2)	3·7	2·07	79	3·8	19·56
5	Basic slag, 3 cwt. (Dates applied as for Plot 2)	4·7	2·07	127	4·6	26·74
6	Nauru phosphate, 3 cwt. (Dates applied as for Plot 2)	5·4	2·3	135	4·4	25·24
7	Super and blood-and-bone, 3 cwt. in equal parts. (Dates applied as for Plot 2)	3·3	2·4	37	4·5	21·88
8	Same as for Plot 7, plus ½ cwt. sulphate of potash. (Dates applied as for Plot 2)	4·8	2·8	71	5·3	25·07
9	Super, 3 cwt. (Dates applied as for Plot 2); nitrate of soda, 1 cwt., 7/10/25, 13/10/26	6·8	2·8	143	7·5	34·99

Slag appears to stand out as a very useful fertilizer for this particular type of pasture and soil, for while the total weights for six years are practically equal to super the bottom growth was denser and of finer quality. From the latter point of view Nauru phosphate also excels. In regard to Plot 1 (½ ton of carbonate of lime 1925 and repeated 1929) it is evident that lime alone is not the controlling factor, as is clearly indicated when 3 cwt. of super (Plot 0) was applied on half of Plot 1 in 1930.

As no duplications of treatments were arranged in the lay-out of these trials originally, with the exception of controls between each, the fact of the plots being long and narrow made it possible to take a number of weighings transversely across both treatments and controls, and thus make comparisons between individual treatments and adjoining controls. A study of the yields of controls adjoining the various treatments from Plot 0 to Plot 9 is interesting, as showing the gradual variation of the field from one end to another, at right angles to the plots, the yields of which rise from 1·6 tons per acre to 2·8 tons per acre without manure. This factor makes it imperative that the results of various manures should not be judged by comparison between themselves, but on a percentage basis of increase or decrease between each individual manure and the adjoining controls—hence the column showing percentages of increases.

This basis of comparison establishes the remarkable fact that super and lime (see Plot 2), although declining in effect as compared with the previous year (1929) as a result of no application in 1930, still continued to exert a strong influence on growth. Straight super (see Plot 3) also shows a remarkable residual effect. Basic

slag, as would be expected, evidently provided sufficient residue to continue growth on a par with the previous season, while the residue from Nauru phosphate evidently effected an improvement in yield. It seems clear that both the latter are steady builders of fertility on this type of soil. Basic super, although not at all outstanding throughout the whole period of the trial, maintained its yield as a residual effect in the past season. Super and blood-and-bone shows a decline, probably due to no application of super in 1930. However, yields from this plot have been among the lowest throughout the period of the trial, and the high cost of this type of fertilizer does not appear warranted.

The addition of sulphate of potash in Plot 8 would seem to have increased the yield over Plot 7, and the lack of an application of super in 1930 appears to have resulted in a decline.

The yields from Plot 9, although showing a decline from the previous year, are still heavy, and, as indicated by the control, points to this portion of the field being higher in fertility. No doubt coarser grasses such as cocksfoot, &c., were stimulated by the two applications of nitrate of soda which, together with super, encouraged a heavy top growth of inferior quality. This plot well illustrates a fact of economic importance—more profitable results from manuring the better land. The comparison of control plots shows that Plot 9 was originally better than most of the remainder of the field under trial, and the increases in yield have also been greater over six years.

Very little importance can be attached to this year's results of nitrate of soda, which was last applied in 1926. Plot 9 bears out the fact that little, if any, residue would remain from nitrate of soda, so that the residue from super is apparently responsible for the 1930 results. It will be noted that the yields, as shown in Table 1 for 1930 (with the exception of Plot 0), represent entirely the residual effect in 1930 from manures or lime applied from 1925 to 1929.

BRICE'S SECTION (TABLE 2).

The general remarks on the original composition of the pasture, as stated earlier, are clearly indicated by the control on this section. As a result of no application last year, super shows a decline here also, as in the case of Moss's section; and this is all the more in evidence when it is considered that the natural growth increase on the control for the 1930 season is slightly over 1 ton ahead of the 1929 season. At the same time it is remarkable how well 8 cwt. of super and 1 ton of lime in nine years has held up the total return, against 16 cwt. each of slag, Nauru, or Ephos during the same period, and it seems clear that the combination is profitable (see results of lime and super, Table 1, Moss's section).

Slag, Ephos, and Nauru each have increases more or less, even though no application was made last year, entirely as the result of residual accumulation. The quality of the herbage on these plots has steadily improved by the invigoration of clover and trefoil.

Table 2.—Brice's Section (Field 3A).

Plot No.	Treatment per Acre.	Green Weight per Acre — One Cut, 1930.	Green Weight per Acre — One Cut, 1929.	Total Green Weight per Acre—One Cut Annually for Seven Years.	Increase over Average of Controls for Seven Years.
		Tons.	Tons.	Tons.	Tons.
1	Carbonate of lime, 1 ton, 9/8/21; super, 2 cwt., 9/8/21, 11/8/24, 28/5/26, 15/8/29	6·33	7·4	43·76	31·09
2	Bone-char, 4 cwt., 9/8/21; Nauru (special fine), 4 cwt., 11/8/24, 28/5/26, 15/8/29	7·66	7·8	44·27	31·60
3	Walpole phosphate, 4 cwt., 9/8/21; Nauru phosphate, 4 cwt., 11/8/24, 28/5/26, 15/8/29	7·86	8·5	47·27	34·60
4	Nauru, 4 cwt., 2/11/22, 11/8/24, 28/5/26, 15/8/29	7·91	7·3	44·41	31·74
5	Control	3·71	2·6	12·67	..
6	Basic slag, 4 cwt., 14/7/21, 11/8/24, 28/5/26, 15/8/29	6·36	5·5	35·16	22·49
7	Nauru, 4 cwt., 14/7/21, 11/8/24, 28/5/26, 15/8/29	7·04	5·7	35·81	23·14
8	Ephos phosphate, 4 cwt., 14/7/21, 11/8/24, 28/5/26, 15/8/29	7·01	5·8	38·32	25·65

FOLLETT'S SECTION.

Increased yields of controls in the phosphate series by 2 tons per acre over the previous season's results as shown in Table 3 can be credited to seasonal influences, and by the same reasoning it is obvious that the actual yields from the residual effect of manures should be discredited by 2 tons per acre. This being so, it is evident that the residual effect from the phosphatic manures has been fairly consistent.

Table 3.—Follett's Section.

Series No.	Treatment per Acre.	Green Weight—One Cut, 1930. Average of Fourteen Manured Plots.	Percentage Increase over Average of Fourteen Controls.	Green Weight per Acre, 1929.	Total Green Weight per Acre—One Cut Yearly for Four Years.
		Tons.		Tons.	Tons.
1	Super, 3 cwt., 30/7/27, 23/7/28, 15/8/29	12·28	22	10·7	37·03
2	Ordinary Nauru, 3 cwt. (Dates applied as for No. 1)	11·6	15	10·3	34·4
3	Special fine Nauru, 3 cwt. (Dates applied as for No. 1)	12·15	20	10·4	33·42
4	Seychelles, 3 cwt. (Dates applied as for No. 1)	10·95	9	10·8	34·64
5	Controls (average)	10·1	..	8·0	25·68

Table 3A.—Follett's Section.

Series No.	Treatment per Acre.	Green Weight, One Cut, 1930. Average of Three Manured Plots.	Green Weight, One Cut, 1930. Average of Six Control Plots.	Percentage Increase over Average of Six Control Plots.	Green Weight per Acre, 1929.	Total Green Weight per Acre—One Cut Annually for Four Years.
		Tons.	Tons.		Tons.	Tons.
1	Sulphate of ammonia, 1 cwt., 20/9/27, 29/9/28, 19/9/29	6·91	6·36	9	11·1	27·45
2	Nitrochalk, 1 cwt. (Dates applied as for No. 1)	8·34	7·93	5	11·3	29·44
3	Nitrate of soda, 1 cwt., 20/9/27, 29/9/28	9·42	9·15	3	9·4	27·91

As would be expected, sulphate of ammonia, nitrochalk, and nitrate of soda have exhausted themselves more or less in the season of application.

Table 3B.—Follett's Section.

Series No.	Treatment per Acre.	Green Weight per Acre—One Cut, 1930. Average of Twenty-eight Manured Plots.	Percentage Decrease.	Green Weight per Acre, 1929.	Total Green Weight per Acre—One Cut Annually for Four Years.
		Tons.		Tons.	Tons.
1	Sulphurophos, 3 cwt., 30/7/27, 23/7/28, 15/8/29	9·53	2·45	9·5	32·65
2	Super, 3 cwt., 30/7/27, 23/7/28, 15/8/29	9·77	..	9·9	34·67

The difference in yield from a number of replications of Sulphurophos against super shows the latter slightly in the lead over the previous four years, but little difference in the season under review, probably due to the levelling-up, as a result of no applications of either during the past season.

As no treatments were repeated on this section in 1930, any increases or maintenance of yields, apart from seasonal influences, can be reasonably credited to residual effect of previously applied dressings. As evidenced by the yields of controls, the inherent fertility of this field continues fairly high, while at the same time there is considerable variation. The dominant herbage is dense brown-top, with a fair proportion of sweet vernal. The quality of the covering on the phosphate plots is beginning to improve as trefoil and white clover develop; but the slow and uneconomic development of *quality* as in this instance, where *quantity* is not lacking, well illustrates an important factor in pasture development and management not always indicated by yield—namely, that quality as well as quantity must be economically produced,

and that the profits from correct manuring are in relation to the composition of the pasture under treatment. In other words, it is well demonstrated here that it would be much more economical to renew similar pastures rather than attempt the impossible by manuring alone where the composition is undesirable.

Ensilage Sheep-feeding Trial.

In order to demonstrate the possibilities of wintering sheep on ensilage, eighty four-year store wethers were purchased on 27th May, 1930. A month later a start was made to feed ensilage, but, owing to the fact that these sheep were off high country and had not been used to paddock feeding, some little difficulty was experienced in the beginning, before they acquired a liking for the silage. Unfortunately, to make matters worse the only paddock available for the trial as well as being too large contained a fair amount of roughage. In view of these conditions it was found necessary to graze down the pasture quite bare before the sheep could be induced to take to the silage, but having once started to feed they did extremely well, and were carried on entirely on silage until the 20th September, when they were changed on to grass for eight days, and fifty-four sold as fats at a profit of 10s. per head. The remainder were in good forward condition and were sold later as fats. The silage had been made by the usual stack method from grass (Field 5) the previous summer, and was of average quality. This trial goes to prove that not only can sheep be maintained in good condition on silage, but that they will even fatten on it. The quantity fed per head for the period stated would average approximately between 5 lb. and 6 lb. per day.

Special Grassland Investigation.

The Crop Experimentalist (Mr. A. W. Hudson) reports as follows on the special grassland investigation which is being conducted on the Area: "The work outlined in the last report on the Marton Experimental Area (see *Journal of Agriculture* for January, 1931, p. 31) is being continued. An introduction to a series of articles on the work was published in the *Journal* for August, 1931. This dealt with some aspects of recent British work on grassland, the objects of the investigations at Marton, and a detailed description of the technique and points affecting technique. Reports on the various experiments are in course of preparation for publication in subsequent issues of the *Journal*."

Sterile Patches in Hauraki Plains Pastures.—In his annual report for 1930–31 Mr. B. C. Aston, Chief Chemist, Department of Agriculture, remarks: "In certain coastal areas of the Hauraki Plains development of sterile patches in the pasture has given rise to some concern. An investigation and analysis of some of these areas revealed several injurious conditions all traceable to the influx of saline water from the drains and subsoil. The lime in the soil has been largely replaced by magnesium and sodium, which occasioned what is known as a deflocculated or puddled clay with a slightly alkaline reaction. Manurial treatment can afford only a temporary improvement, and the solution must lie in the provision of adequate drainage and the cultivation of those species of pasture plants and crops which naturally flourish under such conditions—*e.g.*, strawberry-clover and rape."

CONTROL OF OIDIUM IN VINERIES.

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

A HUMID stagnant atmosphere with a temperature above 58° F. is favourable to the development of oidium or powdery mildew in vineries. Fresh air is essential to the control of this fungus, but draughts must be excluded, or it is almost sure to make its appearance.

Where the fungus is already in evidence it can be killed by spraying with hot water (160° to 170° F.) during the hottest part of the day (11 a.m. to 3 p.m.). By mixing two parts of boiling water and one part of cold water this temperature can be obtained approximately. Dusting the vines with dry sulphur should follow after sunset. Finely divided sulphur, sublimated or finely ground, gives the best results, and is most easily and effectively applied with a sulphur-bellows or a dust-gun.

The fungus can also be destroyed by a solution of Condy's crystals (permanganate of potash) made with sufficient water, to which ½ oz. of slaked lime per gallon has been added, to reduce the colour to a light pink. This spray is very effective, but care should be taken in applying it, as it marks the paint. It does not act as a preventive, and should also be followed by sulphur.

As a preventive of the annual recurrence of oidium, dry sulphur should be applied early in the season to the vines, and particularly to the breaking buds where the fungus hibernates; and some should be scattered along the top and bottom plates and over the floor of the vinery. It is the fumes or emanations which arise from the sulphur at a temperature of 80° F. and over that destroy the fungus. The shoots are dusted again when 4 in. to 6 in. long, and again when the flowers open. Applications can be made later at fortnightly intervals, if considered necessary.

Under dry conditions, when vines are syringed with water to assist the buds in breaking, sulphur can be applied with the water daily until the shoots are 3 in. or 4 in. long, after which dry sulphur can be used. To mix the sulphur, dissolve 1½ oz. soap in 4 gallons of water, then with a little of the water added to 1 lb. of sulphur make a paste and add to it the remainder of the water, gradually mixing the whole thoroughly.

As dry sulphur is liable to cause irritation in the operator's eyes, rubbing them should be avoided, and when dusting is completed all sulphur should be carefully removed from the face, and the eyes, if affected, bathed in a weak solution of bicarbonate of soda, borax, or with a little sweet milk.

A solution of potassium sulphide or liver of sulphur dissolved at the rate of 1 oz. to 3 gallons of water, or lime-sulphur at the rate of ⅓ pint in 4 gallons water, are both good controls, and do not affect the eyes; but both disfigure the white-lead paint with which vineries are generally painted. It is claimed, however, that zinc paint is not affected by sulphur sprays.

These liquid sprays are applied at the same periods of growth as the dry sulphur, with the exception of the flowering period, when dry sulphur only should be used.

SEASONAL NOTES.

THE FARM.

Pasture Utilization and Ensilage.

JUDGING from the condition of pastures at the beginning of October the problem of the best summer utilization of pasture-growth will not call for attention this season as early as it usually does; but in normal years between October and the end of the year, on practically all farms which are devoted principally to butterfat or to fat-lamb production, the matter of the effective utilization of grass-growth is apt to present an acute problem. The problem is that involved in preventing the grass from growing up and producing stalks. While it is at times difficult to find an effective solution of the problem if it has not been anticipated, yet, fortunately, if the problem has been anticipated good utilization resolves itself into the timely taking of easy measures. On many farms the key to the solution lies in ensilage. The work relative to ensilage is likely to be greatly lightened by intelligent preparation.

A main objective of the preparation should be the avoidance of all tedious unnecessary labour. On many farms there is still ample time to prepare conveniently located ensilage pits or trenches, about which information may be obtained from the officers of the Fields Division in the various districts. Cartage and unloading of the heavy green material by labour-saving devices such as home-made or purchased sweeps and hoists should also be arranged. The outlook of the man who persists in doing ensilage work without the assistance of modern devices and equipment is as a rule substantially similar to that of a man who would handle a herd of eighty cows without the aid of the modern shed and milking-machine.

It is probable that some hesitate to embody ensilage in their grass-farming because of lack of experience of the operations involved, coupled with an impression that these operations call for specific training and particular skill. Really, ensilage work is simple, and generally more straightforward than is haymaking. General guidance regarding the work is provided in the Agriculture Department's Bulletin No. 146. Two of the most common causes of relatively inefficient work in ensilage are (1) cutting the material at too late a stage, and (2) allowing the temperature of the stored green material to become too high.

If the pasture growth for ensilage is allowed to become too mature three of the advantages that ensilage has in comparison with haymaking are likely to be at least partially missed. In the first place, late cutting lessens the certainty of obtaining a substantial leafy aftermath, which is of great potential value, especially when an early dry summer spell occurs. Secondly, the later the cutting of the herbage the greater the injury to the sward by shading. And, thirdly, the later the cutting, once a tendency to flowering has been reached, the poorer is the nutritive value of the herbage for wet stock. This point is of considerable practical moment; herbage which has been allowed to come into full flower before being cut may provide silage which would serve quite well for the winter feeding of dry stock, but when milk production is the objective silage made from pasture material cut just when the herbage shows signs of flowering may be expected to give much better results than silage from herbage cut at a maturer stage from a similar sward. From this it follows that where a considerable amount of silage is saved on a farm it is an advantage, apart from other considerations, to divide each year's silage crop into two lots. When this is done the stack or pit containing the less mature material may be used

for feeding milking-stock and the more mature reserved for the feeding of stock which are not producing milk.

From green herbage one may make either green silage or brown to blackish silage—the colour will be determined by the amount of heat that is allowed to develop in the stored material. It has been established that green silage, which is produced at lower temperatures, is superior in feeding-value to brown silage produced from similar herbage. The production of green silage may be expected if further herbage is added, in the customary manner, to that already stored as soon as the latter begins to sink because of the temperature it has developed. On dairy-farms where ensilage work is done between milkings the adoption of such a rule regarding the speed of building may mean, with stack ensilage, that building each day from the commencement becomes advisable, while with pit or trench ensilage a somewhat slower rate of building is likely to be justified because the walls, by partially excluding air, slow down the rate of development of heat.

The proper utilization of summer growth of pastures has been shown by experience to be as important for fat-lamb production as for butterfat production. Ensilage as a means of obtaining assured supplies of winter feed and of avoiding coarse herbage on the pastures in summer has great potentialities in a valuable dual role for the sheep-farmer. The current position may be summed up by saying that, while these potentialities have been demonstrated, they have not been exploited. There is some satisfaction in the fact that the number of sheep-farmers utilizing ensilage last season marked an increase over preceding seasons, and the results secured by these farmers confirm the previous convincing evidence of the merits of ensilage in sheep-farming.

The Supplementary Crop Position.

In the spring and summer widespread improved attention should be given to an important and wide range of supplementary crops—that is, crops such as mangels, swedes, chou moellier, carrots, and turnips, which are used to supplement the feed from the pastures during periods in which such feed is available only in amounts below those required by the stock.

The supplementary crop position well warrants consideration principally on account of such grassland developments as top-dressing, ensilage, and systematic grazing. The past few years have been marked by increased knowledge and increased enthusiasm in respect to our grassland, and it is very desirable that our zeal in respect of grass-farming be maintained and extended. But it would be a pity if our enthusiasm for grass were allowed to lead to a loss of our sense of proportion. It would be a pity if the sound belief that grass is important were allowed to be transformed into the unsound belief that grass is all-sufficing. In other words, the recognition of the true role of grass in our farming is no justification for practically ignoring the value of other crops, particularly when some of them may give most valuable assistance on the way to improved grass-farming. Yet there is at times evidence of a tendency to focus attention too completely upon the pastures alone, and to conclude that through such practices as top-dressing more can be accomplished than actual results give grounds for expecting. Top-dressing, ensilage, systematic grazing, are all intrinsically of great proved value, but for maximum success they frequently require to be reinforced by other practices. In brief, there are several links in the chain of agencies, which, acting together, tend to give grass-farming perfection.

It may be asked when should the plough be used on farms on which grass is the dominant crop. While detailed rules capable of general application cannot be laid down in answering this question, it may be said with confidence that the plough should be used as a rule when two commonly occurring circumstances are present.

In the first place, generally, it will prove definitely advisable to plough and grow special crops such as mangels, oats, and turnips whenever some of the pastures on the farm could be improved economically by putting the land under the plough, growing crops, and eventually resowing to grass. The commercial advent of known improved strains of permanent pasture plants has recently further reduced the number of farms on which the plough may not be used with profit—a number which was already very restricted. In the past a man could be pardoned for being satisfied with a weak or worn-out pasture on land which was capable of carrying a much better one, for it was known that there was always a danger of a new pasture not for long remaining superior to the poor one which it displaced. But we now know this danger can be avoided, and this knowledge often removes the last excuse for not using the plough. Of inferior or open pastures over a wide range of conditions it can be said with safety, Plough, sow good strains of permanent plants, and top-dress appropriately, and a good pasture of reasonably long life, if not altogether permanent, will profitably replace an inferior one. Carried over from the days when it was practically impossible to be sure of securing satisfactory permanence in newly-sown pastures even under reasonably good conditions, we still have a tendency to endeavour to repair pastures when we should plough as a first step to their renewal. Top-dressing, harrowing, and surface-sowing of seed, while all useful aids in repairing a pasture, may be economically unsound in comparison with renewal.

In the second place, it is generally advisable to grow arable crops such as mangels, swedes, chou moellier, &c., when this can be done without creating the need for any considerable direct outlay in equipment or labour. And this will be true as a rule even of farms the pastures of which are not badly in need of renewal. In other words, if the crop work can be carried out without detrimentally affecting the routine work of the farm and without necessitating the employment of additional labour, then it is probable that cropping should be done. This is particularly so when the required equipment is still on hand from a time when considerable cropping was carried out.

Many farmers who do some supplementary cropping do not do enough to meet properly the requirements of the stock during periods of grass shortage. The most striking and conclusive annual evidence of this lies in the markedly low prices for stock which as a rule obtain in August or thereabouts—prices primarily due to shortage of feed before the grass begins to provide enough for the stock.

Factors governing Success with Crops.

Field experience shows that in the raising of many arable crops three matters which are of current importance are allowed to bring about reduced yields in a manner which is distinctly unprofitable.

One is the use of inferior seed. The ready way in which some are prepared to save a few shillings or even only a few pence per acre in regard to seed can be correctly described as puzzling. The small saving may be expected to be linked up with poor germination or with poor type or strain of plants. Poor germination may readily mean only half a crop, and the consequent loss of several pounds' worth of produce an acre. Poor strain may mean a mixture of types of plants all of which are not likely to be equally useful in the one crop, or it may mean plants of poor productive capacity, and it may mean both of these. Poor strain is particularly likely to make its influence seriously felt in the potato crop. It also occurs fairly commonly in root crops.

Another matter which brings about avoidable reduction in yields is parsimonious manuring. No specific rules are likely to be of value for

extensive guidance, since local conditions should always be considered, but the present position in this matter may be summed up by saying that while the error of overmanuring of arable crops is practically unknown, that of undermanuring is widespread, and a fruitful cause of unprofitable crops.

The third matter in respect to which our arable cropping is often weak is cultivation—a matter of particular moment at this time because the task of preparatory cultivation is with us. If cultivation is weak the benefits from all other sound practices are at least partially lost.

A Particular Case for High Yields.

Over a wide range of conditions, high yields should specially be made the objective in the growing of annual crops such an mangels, carrots, and potatoes.

In the first place it has to be remembered that until comparatively recently such crops were often grown as an intermediate step in the renewal of worn-out pastures. Hence their place in farm-work was not necessarily dependent wholly on their own merits—a man might grow a crop of roots mainly because he desired to improve the grass cover on a field. But each year, as greater permanency is being imparted to our pastures by such measures as top-dressing and the use of superior strains of the most important pasture species, the amount of land that it is advisable as a pasture-management measure to break up decreases. Consequently, there is a greater tendency to grow annual crops only because of their direct worth. Further, with a reduced area available for such crops, there is created a more urgent need for greater yields to the acre—the need is for approximately the same total tonnage from a smaller area.

In the second place, it is not always clearly understood that high yields are not necessarily to be viewed unfavourably because they involve heavy expenditure. Heavy expenditure on a crop may indeed at times be linked with comparatively low cost of production of nutriment. Hence the man who is inclined to scoff at an exceptionally heavy crop, because of the known high cost of producing it, may easily find his view to be unsound when the position is critically examined. In general, greater expenditure is justified than is usually realized. The mangel crop serves well to exemplify the general position. Field evidence leads to the conclusion that there are more mangel crops which yield in the vicinity of 30 tons per acre than there are crops which yield in the vicinity of 60 tons. The question of practical importance is, Would it pay to spend money in increasing the yields from 30 to 60 tons? Providing climate is not the factor limiting yield, this increase could usually be brought about, but at a cost. An expenditure of £4 10s. an acre on cultivation, seed, and manure may be necessary to secure a crop of 30 tons per acre. The expenditure of another £6 an acre may make it possible to secure a crop of 60 tons—an additional 30 tons per acre. At first sight this may seem bad business, since the additional £6 produces only 30 tons extra, whereas the initial £4 10s. gives 30 tons. However, if a rental charge of £4 10s. an acre is included in arriving at the cost of the mangels—and a rental charge should be included—then the matter appears in a different light which indicates the true position. Then a 30-ton crop of mangels costs £9—£4 10s. for rent and £4 10s. for cultivation, seed, and manure. In this case the mangels cost 6s. a ton. Against this the 60-ton crop costs £15 an acre—£4 10s. for rent and £10 10s. for cultivation, seed, and manure. In this case the mangels cost 5s. a ton.

The important point that this instance exemplifies is that heavy expenditure on a root-crop on fairly highly priced land, provided it is sufficiently reflected in the yield, may actually reduce the cost of producing a given quantity (say a ton) of stock-feed.

Growing of Mangels.

The mangel is not grown as extensively as is warranted by its valuable characteristics. It is particularly dependable not only because during dry seasons it fares better than most other available crops which meet the same needs, but also because it is not subject to any serious disease. It yields heavily if suitably treated (yields of 60 tons and more per acre are obtained over wide areas) and the crop is relatively nutritious. But it is of practical moment to note that if not suitably treated the mangel will give disappointing results. Poor preparatory cultivation may readily limit the yield of a crop.

Judging from field experience, the variety Prizewinner Yellow Globe deserves the popularity which it has won. Other varieties, such as Red Intermediate, White Sugar, and Orange Globe, have also been giving good results. The mangel generally responds profitably to liberal manuring; a dressing of 5 cwt. per acre or more is frequently justified, and a mixture consisting principally of superphosphate and blood and bonedust in equal parts may be used with confidence. A further dressing of about 2 cwt. per acre of kainit, applied separately about a week before seeding, is widely favoured. It has become standard practice to sow about 6 lb. of seed in rows 26 in. to 28 in. apart. It could with advantage be realized more generally that wet, cold conditions readily cause poor strikes, so that some delay in sowing to obtain warmer soil conditions is often advisable.

The Carrot Crop.

Success with carrots comes most readily as a result of thorough cultivation of a free loam. Good crops frequently receive from 3 to 5 cwt. per acre of manure, and a dressing consisting of two parts of superphosphate and one part of blood-and-bone is dependable. Popular varieties are Matchless White, Barriball, White Belgian, and Guerande. The latter variety is a most suitable variety for sheep, and should be sown in rows 21 to 28 in. apart, using 1½ lb. of seed per acre, this not necessitating thinning. Good crops are frequently obtained from hand-thinning and cultivating carrots sown in drills 14 in. apart, but the practice of sowing in drills 21 to 26 in. apart also gives good crops. The amount of seed generally used is 1 to 1½ lb. per acre.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Disease and Pest Control.

THE unsatisfactory results obtained from some of the commoner washes, the high cost of material, and the additional labour required for the ever-increasing number of applications now being made for the control of orchard pests and diseases has caused considerable activity on the part of our research workers and others interested in commercial fruitgrowing. The ultimate goal is to increase effectiveness at reduced cost in material and number of applications—not to find out the strongest at which the material can be applied without injuring the tree or the greatest number of applications which the tree will withstand, but the weakest dilution at which a particular spray can be *successfully* applied and with the fewest number of applications. As a result, it might well be said that our spray schedules are at present in a state of flux. In the meantime, therefore, growers who feel that they have a safe and effective programme would be well advised, at any rate this season, not to drastically depart from past practice, at the same time keeping in contact with those who are in close touch with the new movement.

It is regrettable that reference so often has to be made to the lack of thoroughness in the application of sprays, even among a number of our better growers. In the control of red mite, for instance, a very few patches, the size of the end of a lead pencil or less, scattered over a tree leave many points for fresh infection, and the tree is very soon again covered with the pest. In spraying, one is liable at each application to drive the team of the portable sprayer or work the hose of the stationary plant in the same direction, doing the same tree first and commencing on identically the same spot on that tree. If a portion is missed the first time it is liable to be again missed on subsequent occasions. An endeavour should be made to avoid this by taking a different direction with each application, such as starting at the top of the row on one occasion and at the bottom on the next, or, with the stationary plant, working round one way at the first application and reversing it on the second.

Pip Fruits.

When these notes reach growers in the earlier districts the calyx spray for codlin moth will have been applied or will be in the course of application. In later districts early November should see this operation completed. Some growers, especially in Otago, have not yet realized the necessity for this spray, and often delay it until the eye of the young forming fruit is closed. In Otago the delay may be safe in some seasons, but a season occasionally occurs which upsets all calculations, with disastrous results. Moreover, seldom is it unnecessary to apply a spray at this period for other pests and diseases; indeed, it is generally necessary to apply it as soon after blossoming as possible so as to lessen the time which has elapsed since the pink spray. The addition of arsenate of lead, therefore, is a very small item, and will act as an insurance.

With the calyx spray of 1½ lb. powder arsenate of lead per 100 gallons of water for the control of codlin moth may be combined other insecticides and fungicides. If control of leaf-hopper is necessary include 1 pint of Black Leaf 40. Bordeaux mixture, 3–4–50 (3½–2–50 if hydrated lime is used), or lime-sulphur, 1 in 120 to 170 according to the strength (sulphide sulphur content) of the material purchased, will be necessary if black-spot is troublesome; of the two, lime-sulphur is preferable on varieties subject to russet, or if either powdery mildew or red mite is a factor.

Later sprays will probably consist of applications of arsenate of lead, 1½ lb. per 100 gallons water, lime-sulphur, 1 in 120 to 170, and a finely divided sulphur, 2 to 5 lb. per 100 gallons, according to the article used. It will be necessary to make these applications at intervals of ten days to three weeks according to locality and necessity. By including spreader at the rate of ½ lb. to ¾ lb. per 100 gallons in each application efficiency is greatly increased. The addition of 4 lb. to 6 lb. of hydrated lime to the 100 gallons of wash will considerably reduce any liability to burning of the foliage.

In the event of red-mite infection becoming serious the addition of ⅔ gallon of winter oil to 100 gallons of the mixture will prove very effective. The use of "summer" or so-called "white" oils, although effective against red-mite, must be restricted to applications at such times when there is no residue of sulphur or lime-sulphur on the trees, and neither of the latter should be applied for some weeks after the trees have received an application of a summer oil.

For fireblight control the advice given in last month's *Journal* should be followed.

Stone Fruits.

For the control of brown-rot and other fungi lime-sulphur, 1 in 120 to 170 (according to strength), will probably have been applied at petal-fall. Another application is advisable as soon as the calyces have fallen

from the young forming fruit. When peach-green aphis first makes its appearance add Black Leaf 40, 1 in 800, to the lime-sulphur. As nicotine sulphate, the destroying agent in Black Leaf 40 is in itself inert, it requires such substances as arsenate of lead, bordeaux, lime-sulphur, or soap to liberate the nicotine which is the actual killing agent; therefore, if it is to be used alone, add 2 to 4 lb. of soap per 100 gallons of wash. The effectiveness of nicotine lies in its volatility, and as it becomes more volatile with increasing heat more effective work is done with this spray in hot weather.

Leech on Cherries, Plums, and Young Pear-trees.

With the first appearance of leech eggs on the leaves an application of arsenate of lead, 1½ lb., and spreader, ½ to ¾ lb., per 100 gallons of water should be made. At this time the fruit is not far advanced, and is not likely to have its appearance spoiled by the spray, especially if a spreader is used. This spray gives a good coating to the earlier developed leaves, which will remain for a considerable time. Through the maturing and picking season a spray on a still day directed not at the tree but upwards in the air above it, so that it will fall like a mist on the tree, will afford additional protection to the older leaves, also some will fall on many of the young leaves, while very little will be deposited on the fruit. The leech grub does not remain on one portion of the leaf or even on the one leaf, but travels to a number, and is liable to be poisoned before it has moved very far. Much injury has been done to cherry-trees by neglecting the control of leech during the season when the fruit is on the trees, and considerable protection of the foliage has been achieved with a very light mist in the manner described without disfigurement to the fruit.

Earwigs.

In districts where this pest is troublesome the banding of the trunks of stone-fruit trees with one of the sticky tanglefoot substances now on the market should be immediately undertaken. If, during the season the substance becomes ineffective through dust forming on the surface, rake it through with a stick or apply a little more. For this protection to be effective the trees must be free of herbage around the trunk, otherwise the earwigs will use a stem of grass or weed to bridge the banding. Baits poisoned with sodium fluoride have been found very effective in reducing this pest.

Cultivation.

Where the soil has been worked down to a good tilth harrowing, with an occasional heavier working with cultivator and disks, especially after heavy rain or irrigation, will be the main operation in this branch of operation. Where difficulty has been experienced earlier in the spring in obtaining efficient pulverization of the soil, the opportunity should be taken when clods have been softened by rain. Every effort should be made to conserve the moisture in the soil by regular and intelligent working with the most suitable implement at the time, so that the top soil is friable, devoid of lumps, and has an even surface but without a crust, so that the smallest surface possible is exposed to drying winds, and yet leaving it in such a condition that the air can percolate through. Such a condition of soil will materially assist the action of the bacteria in changing the unavailable plant-food already in the soil and that supplied by manures into a form in which the trees can absorb it, thus assisting growth, increasing the leaf-surface, and, in consequence, improving the quality of the crop generally.

Those in the South who have sown a cover-crop of red clover should keep mowing it from time to time as required and leave it on the surface to rot. In this way the soil is not robbed, and a great increase in humus and nitrogen will be available for turning under in one or two years' time.

Irrigation.

Outside Central Otago systematic irrigation is only practised by a few isolated growers. Anything from four to eight applications of water are made during the season in that district. There is little doubt that in some other districts in different parts of the Dominion, notably in Marlborough and on the east coast of the North Island, considerable benefit would accrue in some seasons were cheap water available for, say, one or at most two irrigations during mid or late summer. Where irrigation is practised in this country the most suitable method is running the water with the least possible fall in not less than four but preferably six furrows in each bay. Actual details must be determined by the quantity of water and the length of time for which it is available on each application, but slowly trickling water, in small quantities in many furrows over a longer period is usually more desirable than a fast-running stream in two furrows for a short period. It is wise to irrigate early in the season when there is sufficient water supply available, as, in its somewhat moister condition at this season of the year, the soil will absorb the water to a greater depth, thereby creating a reserve, so that future irrigations, at not too infrequent intervals, would not need to be so heavy. It is always unwise to wait until the trees are actually in need of water. Orchards temporarily sown down to clover or with a growth of weeds will require more water than those under clean cultivation (other things being equal), owing to the considerable evaporation of water through the leaves of the cover-crop in addition to that from the foliage of the fruit-trees.

Grafts and Buds.

Trees that have been worked over either by budding last autumn or grafting this spring, must receive constant attention. Almost daily visits are necessary for a while to see that no openings have been caused by the growth of the scion. Many a graft has been saved from an early death by pushing over the cracks a little of the surplus wax which is almost always to be found around the working, thus excluding the air from the union. Where there have been misses, healthy shoots should be encouraged to grow from the stock by protecting them from overgrowth of undesirable shoots; the former can then be budded in the autumn to fill up the gaps with very little loss of time. Remove as few as possible of the shoots coming from the stock, but control them by shortening back; they will assist very materially in keeping vigour in a tree that has already been so severely dealt with by heading back for reworking.

Thinning the Fruit.

The thinning of all stone and pip fruit, especially peaches, nectarines, apricots, and apples, is now recognized as essential to the proper maturing of a good-quality crop. In Central Otago it is a regular orchard practice with practically all stone and pip fruits, its neglect being looked upon just as severely as the omission of pruning or spraying. Much will depend on the vigour of the tree and the surrounding circumstances as to the extent of thinning necessary, but it is good practice to thin heavily on poorly growing trees leaving more fruit to mature on the more vigorous ones. In these times only high-quality fruit is likely to command good prices, especially in the case of stone fruit. Eliminate, therefore, poor and marked fruits, and any surplus above which it is considered the tree can mature to a good size and grade. To get the best results thinning should be done early—that is, as soon as the early drop is over. In districts where late spring frosts occur it may be well to thin twice, merely singling the fruits as early as possible at the first thinning, and giving a final one when danger from frost is over.

Miscellaneous.

There are many odd jobs requiring attention which may not have been completed during the winter. Every spare moment should be concentrated on these, so that everything is in readiness when the crop is ready for gathering. The making of cases, and the repair of stone-fruit crates where such are used, should be pushed on. The dipping of trays and crates in a bluestone solution, 1 lb. in 50 gallons of water, is a wise precaution against transit rots. The packing-shed, including such important machinery as the grader, nailing-down press, &c., should as opportunity offers receive a thorough overhaul and cleaning, instead of being left until they are actually required.

—W. R. Lloyd Williams, Orchard Instructor, Alexandra.

Citrus Culture.

At this period of the year growers should endeavour to attend to cultivation. The ground around the trees should be worked up fine, and care should be taken not to damage the feeding roots.

When the main blossoming of lemons is finished and the young fruit is showing it is advisable to spray with bordeaux, 4–4–40, for the control of verrucosis. This disease if not controlled will produce a rough scabbed condition on the surface of the fruits, thus reducing the value.

All ripening fruit should be picked as soon as ready — say, at 2½ in. diameter, so as to allow the development of the new season's crop. Such fruit if left to ripen on the trees becomes large and coarse, with a thick skin and practically no juice content, and the fruit is of little value.

Any sickly trees should be carefully examined for collar-rot and other diseases. An oil spray, followed by an application of nitrate of soda, will stimulate growth. Banking up of soil around the trunks of the trees should be avoided, as it tends to hold the moisture which assists the progress of collar-rot.

Young borers will now be active, and can be located by their fresh castings. The most satisfactory method for the control of this pest is to inject benzine into the holes and plug them with soap.

When the young growth commences a watch should be kept for red scale and thrips. As soon as they appear an application of red oil should be applied at strength 1 in 40 to 1 in 60, depending upon the vigour and health of the tree. Where trees are more or less debilitated the application made should be weaker than that applied to trees in a more vigorous and healthy condition.

Budding may be done during October or early in November, or deferred until the bark lifts freely in the autumn. If the work is done in the spring the shoots may be headed back to the bud by Christmas-time, and a good growth produced by the autumn, but the latter shoots will stand over and can be headed back in the following spring.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Rearing of Ducklings.

ALL hatching operations should have now ceased except in the case of ducklings, which by reason of their early maturity can be hatched even up to the end of November for the renewal of the laying flock, and even later where the birds are intended for table purposes.

Many people fail to hatch duck eggs successfully in an incubator. There may be several causes for this, but probably the chief one is failure to provide sufficient moisture or to provide it in the right manner to ensure

that the air-cell will dry down to a desired line, whereby the membrane next to the shell will not be too tough for the bird to pierce. After the fourteenth day the eggs should be sprayed with water at a temperature of 103° F.; through the mouth will do. Spray immediately after the eggs have been turned, and then put them back in the machine. They should not be cooled after spraying. The cooling should be done at night and the spraying in the morning. This process should be repeated daily after the fourteenth day until pipping-time, when if the temperature has been maintained at the right degree throughout—102° the first week, from this on to the pipping stage 103°, and 104° when hatching—the incubation process should proceed satisfactorily.

If the correct degree of heat has been maintained in the incubator the eggs should commence to pip on the twenty-sixth day and to hatch out on the twenty-eighth. Beware of the common mistake of trying to help the young birds out of the shell until they have been given their full time to hatch. When once the eggs have commenced to pip, the door of the incubator should not be opened until the hatch is practically cleaned up. Where, however, any of the pipped eggs make no progress at this stage it will generally be found—in fact, it is almost a certainty—that more moisture is demanded. The most effective method of providing this is to take a piece of thin flannel the size of the egg-tray, dip it in hot water, wring it lightly, and then place it over the eggs. The flannel may be left on for, say, an hour. If the covering is not too thick the birds will have no difficulty in hatching under it. During the final stages it may be rolled up and left at the end of the machine next to the heater until the trays are removed from the incubator.

During the early stages the eggs require very little cooling. After the second day they should be turned both morning and night. Usually the time it takes to do this is all the cooling they require for the first week. In the second and third weeks the time of cooling should be extended by degrees up to twenty minutes, or even half an hour, while during the last week if warm weather conditions prevail, they may be left out much longer. After being set for four or five days the eggs should be tested and the infertile ones taken out. Frequent tests should be made, and during the incubation process any eggs containing dead germs should be removed promptly from the incubator. Such eggs rapidly decay and soon give off a bad odour, which is apt to injure the hatching-qualities of the remaining eggs in the incubator. Usually the shell of a decaying duck-egg becomes discoloured, and can be readily detected by a person of experience without the use of a tester.

Ducklings can be successfully reared by means of either a heated or fireless brooder, providing they are given every opportunity to secure plenty of fresh air, a factor which is one of the chief secrets in rearing brooder ducklings. Stuffiness must never be allowed to exist under the hover, or the mortality is apt to be great. The common trouble of staggers is frequently due to placing the young ducklings in a badly ventilated brooder. As is the case with chickens, ducklings should not be fed for thirty-six hours after hatching. During the first week the food may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, and with, say, 5 per cent. of fine grit (not sand) added. Feed four times a day, giving all the birds will pick up in about ten minutes.

When the ducklings are about a week old the grit is better not mixed with the food, but it should always be available to them in a wide shallow receptacle, so that they can help themselves. As the birds develop the oatmeal may be dispensed with, while ground wheat, hulled barley, or maize-meal may be included in the mash. Finely-cut green food, such

as silver-beet, lettuce, or young tender grass, should be fed daily after the fourth day. Well-boiled wheat makes a splendid change of diet for growing ducklings.

Water should be given with the first meal, and from then onwards it should be in reach of the birds both day and night. This is not to say that the water-vessel should be left in the brooder (except perhaps for the first day or so), but rather that the ducklings should at all times have access to the brooder run where the water-vessel is placed. It is of the greatest importance not to give them water after a long fast. It is safe to say that thousands of ducklings are lost annually by failure to observe this rule. When ducklings are confined in a brooder by night without water, and a heavy drink is given them before receiving their morning meal, fatal results are almost sure to follow. Ducklings affected from this cause will give every indication of being affected by a fit or sunstroke. They usually stagger and fall on their backs with their eyes twitching, and death soon follows. If by any chance it is found that the water-vessel is empty it is always a good plan, especially during cold weather, to take the chill off the water before giving it to the young birds to drink, and even then a light drink only should be provided at first. In this way the trouble will be reduced to a minimum as compared with the giving of cold water, which often has the effect of chilling the birds with fatal results. As before indicated, however, the only way of preventing this trouble is to have water within reach of the birds at all times both by night and day.

Care should be taken to have the water vessels of sufficient depth for the birds to wash off any food from their nostrils, and at the same time to give them a clean out. If the nostrils are allowed to clog the eyes become plastered, while lameness, weak backs, and an unthrifty condition soon sets in.

A rather common trouble with brooder ducklings is leg-weakness and apparent paralysis of the limbs. The invariable cause is allowing the birds to sleep in damp quarters. Although ducks are a water fowl, it is imperative that the sleeping quarters of old or young birds which are being kept under artificial conditions should be maintained in the driest condition, or leg weakness and other troubles will result. Once a duckling looses the use of its legs little or nothing can be done for it. It is really a matter of prevention by checking everything that tends to create a moist atmosphere.

Owing to ducklings having a thin skull they are very prone to sunstroke, so they should be always well protected from hot sun. Failure to take this precaution frequently causes heavy mortality. Do not on any account overcrowd ducklings by placing more in the brooder than it is capable of accommodating to the best advantage. Work only with numbers that can be handled with absolute confidence. Strict attention to cleanliness and preventing the quarters from getting into a wet filthy state is imperative if the ducklings are to thrive and make sound development.

Fattening for Market.

Ducklings now hatched and intended for the Christmas market must be fed and managed to the best advantage if the maximum price is to be secured for them. A good fattening diet consists of equal parts of maize-meal, pollard, and bran, well moistened with skim-milk; also, where the latter is available, it should be given to the birds to drink. Feed at least three times a day as much as the birds will eat without waste. In addition, finely chaffed succulent green material should be supplied daily, and an ample supply of grit should be available at all times. When ducks are undergoing the priming process they should not be given water to swim in; they will do much better without it.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Importance of Good Young Queens.

ONE of the most vital points in successful beekeeping and the production of good crops of honey is to ensure that each colony is headed by a good young queen. The queen is the mother of all the bees, and upon her depends the strength and vitality of the hive. Her place in the hive and the part she plays in keeping the colony strong in bees and brood is too often overlooked by many producers in the rush of a busy season and the attention to other details which help in the production of maximum crops of honey.

This is borne out to some extent by the fact that quite a number of beekeepers allow their bees to supersede the queen, rather than put into practice one or other of the recognized systems of queen-rearing. By allowing the bees to follow their natural instinct to supersede there is a danger that supersedure of the old queens may take place either in the autumn or the spring, when it is essential to have the queens laying at their best and the hives as strong in young bees as it is possible to get them. Either period is most critical, as a temporary stoppage in egg-laying will seriously reduce the population of the colony, rendering it incapable of surviving the winter or too weak in bees to produce a surplus of honey.

Autumn supersedure, moreover, carries with it attendant dangers, as the weather is usually too treacherous to permit of the drones flying, consequently quite a number of queens are not successfully mated and later develop into drone layers. This invariably means the loss of the colony, as the force of worker bees becoming rapidly reduced is unable to function normally. Again, there are cases where queens have laid well during the season and show signs of failing in the autumn. Such queens in this state that survive the winter will undoubtedly be superseded in the spring, and at a time when the requirements of a colony demand a queen at her best not only to increase the depleted worker force, but to provide strong colonies for the main honey-flow. It is against these possibilities that the beekeeper should guard. He should anticipate the requirements of the colonies and plan to supplement those queens that are failing or, in his opinion, do not come up to the standard necessary to maintain brood-rearing at its highest level.

Among practical beekeepers opinions are divided as to how often to requeen. Some beekeepers requeen every year, others every second year, and some only those colonies in which failing queens are detected, while the majority of apiarists leave the matter entirely to the bees. Whichever course is followed, the preponderance of evidence is in favour of a renewal of queens each year, and it is noticeable that the most successful apiarists are those who follow this plan of action. In doing so they recognize that there is positively no one element that contributes to the production of big yields of honey as much as good young queens.

However, it is quite apparent that the advantages to be gained by following the example of those apiarists who have made a success of the business is not fully recognized, otherwise it is safe to say that the practice of queen-rearing would be more generally practised than it is at present. Perhaps there is no better time to impress its importance on the production of honey than at extracting-time, when the season's crop is harvested. It is at this period that the beekeeper is in the best position to make calculations as to the extra money he would have made if his returns from all the colonies had been equal or up to the standard of the best. Normally colonies run under the same system of management should give approximate returns, and this is supported by the experience of apiarists of standing. However, the average beekeeper who may have given special

attention to the general management of his bees, but has underestimated the part good queens play in producing good averages per hive, has failed to grasp the greatest fundamental in successful beekeeping.

The advisability of breeding from the best queens, those whose progeny are good gatherers, reluctant swarmers, and mild tempered, needs no emphasis. However, these inherent qualities are not so important as the age of the queen and the creation of the right hive conditions. It must be remembered that it is the first season's existence of the queen that counts, and every consideration must be given to the colony to get the best out of her. An occasional queen may continue normal egg-laying during the second year, but it is the exception and not the rule with most queens.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Curing Organic Manures.

IT is at this time that the materials for these valuable manures should be accumulated and properly cured, so that they may be ready for top-dressing berry crops in the autumn and turning under in the winter when land is being prepared for vegetable crops. Animal and vegetable refuse are intended by nature to nourish plant growth, and the neglect to gather and properly store them is very bad management. Chemical inorganic manures are useful as supplementary plant-foods, but they can never take the place of the organic manures which are the source of fertility in soils. As it is rarely convenient to dig them in in a raw state, they should be stacked and fermented in much the same way as ensilage is made. Those who live by the seashore should also remember that seaweed comes under this heading. For further information on this subject see page 362 of the *Journal* for May last.

Small-fruit Culture.

For two or three months, commencing at the present time when the last of the stored apples are being marketed, and terminating in January when the stone-fruit harvest commences in earnest, is a period when the small berry fruits of summer-time are looked for. First come the gooseberries and strawberries, followed by the raspberries and currants in December. The gooseberries are harvested green and firm in a suitable form for culinary use. When of a comparatively even size they look well and are packed to best advantage. All mature berries in the strawberry beds should be gathered every two or three days. If any are overlooked they are either wasted, or, what is worse, gathered when overripe and spoil the pack. Mixed maturity is one of the worst defects in packed fruit. The fruit should be gathered when the surface is dry, and always kept in a cool shaded place while awaiting shipment.

Weak and surplus canes should be removed when hoeing weeds in the crops of raspberries and loganberries. Cape gooseberries should now be planted out; 3 ft. apart and 6 ft. between the rows is suitable spacing on land that is rather rich. Plants of the edible passion-fruit may also be planted, if this is not already done; 8 ft. to 10 ft. between the plants and 10 ft. or 12 ft. between the rows are the usual distances. This distance between the rows appears excessive, and it is possible that 8 ft. or 9 ft. would be sufficient and more profitable. Cultivation to keep down weeds and carefully training the plants on the trellis provided are the main operations at this season.

The Tomato Crops.

Tomato plants in unheated glasshouses will now commence to ripen the lower bunches of fruit. This fact, together with the higher temperatures usually experienced, make it desirable to apply a mulch of strawy stable

manure, which will feed the loaded plants and conserve moisture in the ground. This will save labour and maintain better conditions for the crop. If this is done and a close atmosphere with a high temperature is carefully avoided, there should be no difficulty in ripening the crop satisfactorily.

If the white-fly (*Trialeurodes vaporariorum*) makes an appearance the house should be fumigated overnight with calcium cyanide, a material that slowly gives off a gas which destroys all insect life. Hydrocyanic-acid gas has been used for this purpose for many years. It was done by tipping sodium cyanide into a solution of sulphuric acid. This resulted in a sudden rush of gas which was all released in a few moments, thus making it quite dangerous for the operator if, by carelessness or accident, he should be delayed in the work. The grade of calcium cyanide suitable for this work is known as "G" fumigant. The particles are about the size of sea-sand. The necessary amount can be weighed out, placed in a canister with a perforated lid, and evenly scattered down the paths through the glasshouse by shaking the cannister. This method is cheap, effective, and practically fool-proof. It is safe because the gas is evolved slowly, so that there need be no anxiety on the part of the operator if the work is carried out methodically, and, although only a small amount of the material is required, it is effective because the gas is liberated over a comparatively longer period. The average dose is $\frac{1}{4}$ oz. to 1,000 cub. ft. of space in the house; but if there is much leakage and this dose has not the desired effect the treatment should be repeated after an interval of one week, increasing the dose to $\frac{1}{8}$ oz. for every 1,000 ft. It is sufficiently accurate to regard a level tablespoonful of this material as equal to $\frac{1}{2}$ oz. The cubic feet of space may be ascertained by multiplying the average height by the length and breadth. For instance, in the case of an even-span house add the height to the ridge, say, 10 ft., to the height at the eaves, say, 5 ft., and divide the sum, 15 ft., by two, thus obtaining the average height of $7\frac{1}{2}$ ft. Multiply the average height by the width of the house, say, 25 ft., and the area of the end is obtained, $187\frac{1}{2}$ sq. ft. Multiply the area of the end by the length of the house, say, 100 ft., to obtain the capacity of the house, $18{,}700\frac{1}{2}$ cub. ft. As $\frac{1}{4}$ oz. of calcium cyanide is needed for each 1,000 cub. ft., the house specified would require eighteen and a fraction quarter ounces—say, nineteen, as few glasshouses are very airtight. This equals $4\frac{3}{4}$ oz. of calcium cyanide "G" fumigant which would be required for one treatment.

There are a few other conditions which should be observed. The treatment is best given shortly after sundown on a still evening, so that the leakage of gas will be at a minimum. Spread the cyanide evenly down the centre walk, leave the house at once, and lock the door. If the doorstep is worn, place a wet sack in position to prevent leakage beneath the door.

Other conditions necessary are a moist atmosphere of 55 to 80 per cent. humidity, and dry plants. This would be about the average humidity in a crop of tomatoes under glass during summer, and the plants will remain dry if the temperature of 55° to 75° F. is evenly maintained, since falling temperatures produce moisture. The reason for this is that the calcium cyanide is acted on by the atmospheric moisture, and the gas is thus slowly evolved, but if the plants are wet the water would absorb the gas and the plants would be liable to injury. The explanation may make the operation sound elaborate, but the requisite conditions are easily obtained if no water is given the crop for a day or two before the treatment. The following morning, before the sunlight strikes the plants, the house should be ventilated in the usual way, as very little gas will remain in the average house after overnight fumigation.

A disease known as "stripe" disease is sometimes found in tomato crops under glass. The popular name describes the general outward appearance

of the effects of damage by *Bacillus Lathyri* to the main stem of the plant. The perpendicular stripes are usually thin, black, and sunken. Infected fruit has a pitted appearance, or the leaves have small patches of a dark colour between the veins. Infection should be avoided by sanitary methods, but it is also important to avoid an abnormal state which predisposes the crop to this disease, which is chiefly brought about by an oversupply of nitrogenous food in the early stages of growth. The best treatment for an affected crop is to correct this condition by administering potash. One or two ounces of sulphate of potash per square yard should be given, and repeated if necessary after an interval of three or four weeks.

The outside tomato crop will require light cultivation occasionally to destroy weeds, the removal of laterals from the axils of the leaves before they much exceed 1 in. in length, and tying to their support of wires or sticks every foot or so. In some of the districts where this crop is grown extensively, growers will have very unpleasant recollections of serious loss last season due to a borer destroying the main stem of the plants just above the surface of the ground. Many noticed it first when fine plants heavily loaded with fruit suddenly collapsed. The small caterpillars which were responsible developed into small moths very much like those which attacks the potato in dry weather; in fact, it has been identified as a species of that pest, and was named *Phthorimaea melanoplintha*. It has since been found that an earlier name was given to that genus which, in accordance with the rules of nomenclature, has now been adopted. The scientific name therefore is *Gnorimoschema melanoplintha*.

Where tomatoes are grown a careful watch should be kept for any sign of this attack, so that one may learn as much as possible about the habits of this new pest. It will undoubtedly be advisable to include arsenate of lead with the Bordeaux spray generally used on this crop, and, in applying it, to give special attention to covering effectively the base of the main stem, which is the chief point of attack. Two ounces of arsenate of lead paste, or 1 oz. of powder, should be made into a cream, diluted, and then stirred into the bordeaux, making it up to 4 gallons of spray. To 50 gallons of bordeaux 1½ lb. of arsenate of lead paste or ¾ lb. of the powder form should be used. In a well-made bordeaux this spray should have good adhesion, especially on the rough surface of the plants in question. If the season is dry the protective covering should be maintained by repeating the application as may be necessary.

The Market Garden.

Of the half-hardy crops sown and planted now there is usually a good demand for rock and water melons; also the area in ridge cucumber crops could also be extended with advantage where a light, moist, rich soil in a sheltered position is available. Seed of water-melons may be drilled in rows 9 ft. to 10 ft. apart, and thinned to 2 ft. or 3 ft. apart in the row. For the others mentioned 5 ft. or 6 ft. between the rows would generally be sufficient. They should be thinned to 12 in. or 24 in. apart in the rows. A heavy green cover-crop turned under in good time to decay before planting, or a good dressing of well-rotted farm manure, and 2 cwt. or 3 cwt. of superphosphate to the acre, would usually be advisable.

Hoeing and thinning seedling crops should be attended to promptly. In the cooler districts a sowing of Swedish turnips made in the month of November makes a useful addition to the supply of winter vegetables.

Crops of asparagus and rhubarb are sometimes harvested over a long period to the detriment of the plants. This is usually unsatisfactory, and it is best to discontinue gathering these crops when berry fruits and summer vegetables, such as peas, are on the market. From established crops sticks may be gathered for a period of about eight weeks, after which a dressing of manure should be given and the plants encouraged to make vigorous

growth that will put them in condition to produce a crop of good quality the following spring. Bright, tender, and well-flavoured produce can only be obtained by giving the plants generous treatment.

The Homestead Garden.

New growth on flowering climbers and rambler roses should be carefully arranged and neatly tied in, superfluous growth being checked by nipping out the growing point.

When spring-flowering bulbs begin to crowd, as they often do after being undisturbed for four or five years, they should be lifted as soon as the foliage matures, and ripened off in a shaded, airy place ready for replanting.

Now the rush of spring-time operations is easing off, and frames and boxes have been emptied to some extent, there will be room and time for sowing seeds of late annuals, also biennial and perennial herbaceous plants.

—W. C. Hyde, Horticulturist, Wellington.

BRITISH PHOSPHATE COMMISSION'S NEW STEAMER AT NAURU ISLAND.

The views show the s.s. *Triona*, recently built for the Commission by Harland and Wolff, Belfast, loading phosphate from the Nauru cantilever. The *Triona*, a vessel of 4,413 tons gross, was specially designed for the phosphate trade, and has equipment for handling the deep-sea moorings necessary at Nauru and Ocean Islands. The lower view was taken from the phosphate storage bin on shore.

WEATHER RECORDS: SEPTEMBER, 1931.

Dominion Meteorological Office.

SEPTEMBER proved a most unsettled month, and hopes that the winter type of weather had departed with August were not fulfilled. Temperatures were decidedly cold, particularly during the first half of the month, and once again they were less than the normal throughout the greater part of the Dominion. In some districts, indeed, it was the coldest September experienced since records have been kept. This was the case in Wellington, where the difference below normal was 3·3° F., while at Christchurch it was as much as 4·1° F. A marked feature of the month was the predominance of southerly winds. Although usually they were only moderate in force, those on the 5th, 6th, and on the 9th were severe.

Rainfall.—Rainfall was above normal over the North Island, except in the northern portion of the Auckland Peninsula and on the west side of Mount Egmont. Above-average totals were also experienced along most of the east coast of the South Island, but all the western half, Otago, and the high country had a deficiency, a few places in Westland having less than half the usual amount, while Arthur's Pass recorded only 19 per cent. of its average.

Pressure Systems.—Of the low-pressure systems the greater number were of cyclonic form, and when a westerly depression crossed the Dominion it was invariably followed by a secondary centre developing off the west coast. The changes in wind and weather were consequently very rapid, and days when generally fine conditions prevailed were few and far between. Most of the anticyclones moved in northern latitudes, but an irregular one crossed the Dominion between the 17th and 21st, and during this period fine sunny weather was general, although cool southerlies prevailed over the North Island.

The depressions were too numerous to describe in detail, but a few of the most intense may be mentioned. On the 5th a vigorous cyclone which had moved with unusual rapidity over the North Tasman Sea was centred west of the Auckland Peninsula. It crossed the North Island during the night, and by the morning of the 6th was located off East Cape. On these two days very unpleasant conditions prevailed, and on the night of the 5th a particularly violent southerly was experienced. Rain fell almost generally, and there was a heavy fall of snow on much of the central area of the North Island. It is considered that the fall in the Rotorua and Taupo districts was the heaviest experienced in the past fourteen years. In some places the snow covered the ground to a depth of 3 ft. The east coast districts of the South Island also received snow at this time, but, except in the hill country, the falls were slight.

The 7th was a fine day, while an anticyclone was passing to the north of New Zealand. Pressure, however, fell again next day, and by night-time an intense westerly depression had advanced on to the Dominion with a rapidity almost equal to that of the cyclone which had recently preceded it. By the morning of the 9th the depression had moved to the east of the Dominion, but a slight secondary centre had developed west of Cape Maria van Diemen. The latter brought some heavy rain to the Auckland, Bay of Plenty, and Gisborne districts. On the night of the 10th the secondary centre crossed the Auckland Peninsula, and the wind, which on the 9th had become southerly in and south of Cook Strait, blew strongly everywhere from that quarter, with extremely cold temperatures.

During the night of the 15th a cyclone developed off the Canterbury coast, and this district received a drenching south-westerly rain which continued until the afternoon of the following day. Strong south-westerly winds prevailed generally on the 16th, but by the 17th they had decreased nearly everywhere in force.

After the fine spell already referred to between the 17th and 21st conditions changed for the worse again, and with the exception of brief fine intervals on the 24th and 27th the weather continued unsettled in most districts until the close of the month.

RAINFALL FOR SEPTEMBER, 1931, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	2·40	18	0·56	5·25
2	Russell	2·43	13	0·66	4·19
3	Whangarei	2·64	16	0·90	4·96
4	Auckland	5·12	23	1·09	3·68
5	Hamilton	5·51	20	1·18	4·41
6	Rotorua	5·79	15	1·37	5·17
7	Kawhia	8·03	19	1·41	4·58
8	New Plymouth	5·23	18	0·89	5·40
9	Riversdale, Inglewood ..	8·75	19	1·37	9·77
10	Whangamomona	9·05	16	1·72	7·32
11	Eltham	5·00	19	1·06	4·55
12	Tairua	5·70	18	1·54	4·75
13	Tauranga	4·48	18	1·11	4·43
14	Maraehako Station, Opotiki	5·88	14	1·74	4·26
15	Gisborne	3·93	13	1·55	2·95
16	Taupo	4·06	17	0·84	3·94
17	Napier	3·64	19	1·17	2·17
18	Hastings	3·32	19	1·30	2·57
19	Taihape	5·05	21	0·97	3·16
20	Masterton	3·27	17	0·73	3·05
21	Patea	5·60	18	1·94	3·64
22	Wanganui	3·52	12	1·20	2·93
23	Foxton	3·44	14	0·93	2·47
24	Wellington	3·79	21	0·62	3·11
	South Island.				
25	Westport	8·23	17	1·88	8·30
26	Greymouth	6·40	17	1·25	8·15
27	Hokitika	4·50	14	1·05	9·33
28	Ross	5·53	11	1·55	13·23
29	Arthur's Pass	3·00	6	1·00	15·91
30	Okuru, South Westland ..	11·89	12	5·44	12·60
31	Collingwood	8·18	14	2·22	9·77
32	Nelson	2·45	11	0·84	3·76
33	Spring Creek, Blenheim ..	2·41	9	0·85	2·77
34	Tophouse	4·47	14	1·83	5·95
35	Hanmer Springs	5·55	16	2·44	4·10
36	Highfield, Waiau	3·68	12	0·90	3·03
37	Gore Bay	2·94	13	1·09	3·01
38	Christchurch	2·16	9	0·79	1·73
39	Timaru	2·06	10	0·96	1·93
40	Lambrook Station, Fairlie ..	1·66	8	0·83	2·19
41	Benmore Station, Clearburn	1·65	8	0·95	2·14
42	Oamaru	1·29	8	0·44	1·65
43	Queenstown	2·99	8	1·11	2·55
44	Clyde	1·02	4	0·49	1·04
45	Dunedin	2·88	13	1·34	2·76
46	Wendon	1·30	8	0·44	2·56
47	Gore	..	..	..	2·84
48	Invercargill	3·16	13	1·14	3·28
49	Puysegur Point	4·18	18	0·77	6·60
50	Half-moon Bay	4·06	15	0·83	5·45

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

ANTE-PARTUM PARALYSIS OF EWES.

"FARMER," Ohingaiti :—

What are the outward symptoms and signs of the sheep trouble called sleeping sickness ? We lost a few ewes from what we thought might be this trouble.

The Live-stock Division :—

This trouble, which occurs previous to lambing, is known as ante-partum paralysis, sometimes popularly referred to as sleeping sickness or dopiness. The following are the symptoms of the condition as described in the departmental bulletin on the subject : Premonitory symptoms will only be noted by the careful observer. In a good, well-conditioned flock of ewes, from ten to twenty days before lambing, one or more, evidently heavy in lamb, may be observed to be dull, off feed, and away from the rest of the flock. If approached little or no notice is taken, and when actively disturbed the affected animal will only move off very slowly and in an aimless manner. Later on she will be found standing stupidly, will be with difficulty moved, will not start at the approach of the shepherd, and may not even pay any attention to dogs ; the mouth is clammy, the eyes apparently sightless, and the animal only semi-conscious. Soon after she will be found lying down, and if raised to her feet will only stand listlessly, while if forced to move will stagger a few paces and then probably fall ; the eyes are sightless, there is grinding of the teeth, and probably the wool is found to readily come out. Even in this condition the animal may live for from two to three days. From the time the first symptoms are exhibited until death supervenes a period of from two to eight days may elapse. In the vast majority of cases the disease is only observed when the animal is in the last stages, consequently the course of the malady generally appears much shorter than is really the case.

MILLET AS A FODDER CROP.

"SETTLER," Flaxbourne, Marlborough :—

I have heard from neighbouring farmers that Japanese millet is a good fodder crop for both sheep and cattle. I would be glad if you would give me some information regarding this crop, such as time to sow and seeding per acre, also the best time to feed it.

The Fields Division :—

Millet requires warm conditions and should not be sown before December. The seed should be sown at the rate of about 15 lb. per acre through every coulter of a grain drill, with superphosphate at the rate of 1 cwt. to 2 cwt. per acre. Millet makes rapid growth if conditions are favourable, and is ready for feeding off with sheep when from 6 in. to 8 in. high. If the crop is to be cattle-grazed a little more growth is permissible. Under Canterbury conditions millet is not considered the equal of good rape for fattening sheep, although it is free from the various diseases that attack rape. It will not stand frost well, and usually disappears with the first frosts experienced in the late autumn. Sheep take readily to millet, and it made good growth at Ashburton Experimental Farm. The crop, however, is generally regarded as more suitable for North Island conditions.

QUINCE-TREE CASTING ITS FRUIT.

"SUBSCRIBER," Dannevirke :—

We have a quince-tree that is laden with blossom every year ; the fruit forms, reaches about the size of a walnut, then falls off. It is a very old tree, and there

has only been one good crop within the last ten years. Could you let me know what I could do to stop the fruit falling off?

The Horticulture Division :—

A very old quince-tree that blossoms every year but casts its fruit when about the size of walnuts is either in a weak condition or affected with disease. The fact that one good crop has been borne within the last ten years indicates that pollination is not the difficulty—that is, unless quince-trees in the vicinity have been removed since the crop was borne. A weak condition may be due to the quality or condition of the land or its management. Or, again, as often happens, the branches are too crowded for the blossom to develop and set well. As there are so many possible causes, the problem is best dealt with by a visit from the district Orchard Instructor, who has been asked to call when he is in your vicinity.

COW CHEWING HALF-BURNT STICKS.

S. KING, Landsboro', Timaru :—

While we were burning gorse one of our milking-cows in fair condition persisted in chewing half-burnt sticks. The cows have been running on old run-out pasture and fed on swedes only. There is a heavy clay subsoil, which shows no visible response to lime. Could you suggest what the cow was in search of? What could be given to replace the minerals lacking?

The Live-stock Division :—

The mineral chiefly lacking in these cases are lime and phosphates, and we would advise you to use a lick composed of salt, 28 lb.; bone-flour (sterilized), 50 lb.; air-slaked lime, 20 lb.; sulphate of iron, 2 lb. The apparent lack of response to lime in your soil may be caused through your using an insufficient quantity. At least 1 ton per acre of carbonate of lime is needed on land of your type, followed by an application of superphosphate.

CONTROL OF GRANARY WEEVIL.

"INQUIRER," Otane :—

Would you oblige me with information regarding a small black weevil that gets into chaff and seeds, &c., and advise how to get it out of a building? Last winter it turned my chaff quite hot and destroyed the embryo of some barley-seed. I have sprayed everything I could with dip, and although I have not seen any since, a neighbour, who has kept his stable empty for two years and sprayed it, says the weevil has returned since he put chaff in.

The Entomologist, Plant Research Station :—

The weevil responsible for the damage is most likely the "granary weevil," *Calandra granaria*. Fumigation with carbon bisulphide will kill all stages of the insect without injury to the chaff or grain. A convenient method of treating small quantities of infested material is to fumigate it in an ordinary barrel or airtight bin by pouring in bisulphide at the rate of 3 lb. per 100 cubic ft. of space. Care must be taken to close the receptacle tightly so that little or none of the bisulphide vapour will escape. Allow the fumigation to proceed for forty-eight hours. Carbon bisulphide is extremely inflammable and with air it forms an explosive mixture, so that no naked light or even pipe-smoking should be allowed near it. It is poisonous to inhale in any quantity, and people with heart trouble should not handle this material. If proper precautions are taken, however, there is nothing to fear from its use.

Commercial Fruitgrowing Districts and Fireblight Control.—In the article on fireblight published in the *Journal* issue for August the Gisborne Commercial Fruitgrowing District was inadvertently omitted from the list of such areas given on page 117.

CONTROL OF FOOT-AND-MOUTH DISEASE IN BRITAIN.

THE OFFICIAL SYSTEM AND ITS OPERATION.

AT the request of one of the breed societies of the Dominion we print below particulars of the system formulated by the Ministry of Agriculture in Britain for dealing with suspected cases and actual outbreaks of foot-and-mouth disease. The matter is extracted from the Annual Report of Proceedings under the Disease of Animals Act, for the Year 1928.

Whenever foot-and-mouth disease is suspected to exist either in an animal or in a carcass on any premises in Great Britain, the owner or person in charge of the animal or carcass is required by law immediately to notify the fact to the local police, who are required at once to inform the Ministry by telegram. The police are also required to inform the local authority concerned—*i.e.*, the County or Borough Council. It is the duty of the local authority to cause a veterinary inquiry to be made forthwith into the report, and meantime a notice is served upon the occupier of the premises, the effect of which is to apply thereto the rules to be observed on an infected place to prevent the spread of infection. If the Veterinary Inspector finds that there are reasonable grounds for suspecting that foot-and-mouth disease exists, he is required to issue a certificate to that effect, whereupon the movement of animals out of, into, or within the area lying within a radius of five miles of the premises concerned is prohibited pending a definite and conclusive diagnosis by a whole-time Veterinary Inspector of the Ministry.

The Ministry, on receiving telegraphic information from the police of the suspected existence of the disease, instructs one of its whole-time Veterinary Inspectors to proceed forthwith to the suspected case. Officers are on duty day and night available to issue these instructions so that there may be no delay in diagnosis. If the Inspector, after examining the animal or carcass, is of opinion that disease exists, he has power to extend the area already referred to in which the movement of animals is prohibited from one of five-miles radius to fifteen miles round the infected premises, or in certain circumstances to an area of even greater radius — *e.g.*, where there is reason to believe that a market has been infected. The Veterinary Inspector of the Ministry reports the result of his examination to the Ministry's headquarters by telephone.

On confirmation of the existence of foot-and-mouth disease an Order is made by the Minister of Agriculture and Fisheries declaring an area lying within a radius of fifteen miles of the infected premises to be a "foot-and-mouth disease infected area" for the purpose of the Foot-and-mouth Disease (Infected Areas Restrictions) Order of 1925. No movement of animals out of that area is permitted for any purpose (including export), and movement of animals into and within the area is controlled by license, only necessary movement being allowed. All markets of animals within the area are prohibited, except those for fat stock, which may be held outside a radius of five miles from any infected premises by license of the local authority and subject to veterinary inspection. All dogs within five miles of any infected place have to be kept under control, and hunting in the area is prohibited. (This Order is prepared at the Ministry's headquarters immediately a case is reported, so that there is no delay in issuing the Order if and when the case is confirmed.)

If there is no spread of the disease, the above-mentioned restrictions are maintained for a period of fourteen days, when the area is reduced to one of five-miles radius from the infected premises. The area is further reduced to two-miles radius after a lapse of a further seven days, and this two-mile area is entirely released after a further seven days—*i.e.*, after a period of twenty-eight days from the date of the confirmation of the outbreak. In the event of disease appearing on other premises in the area, movement restrictions may be extended for a longer period, according to the circumstances. Larger infected areas may be scheduled if one or more markets are involved, or if, for any other reason, it is considered necessary to prohibit the movement of animals over a wider area than one of fifteen-miles radius in order to prevent the risk of the spread of infection.

The policy of the Ministry is to slaughter immediately all affected animals and also those which are or have been recently in contact with the affected

animals or otherwise directly exposed to infection. Compensation is paid to the owners of the animals slaughtered equivalent to the full market value of the animals. The object of such slaughter is to destroy as quickly as possible the manufacturers and potential manufacturers of foot-and-mouth disease virus. The manufacturers of virus are the affected animals, and the potential manufacturers are the animals which have been directly exposed to infection. This slaughter is, in the majority of cases, completed within twenty-four hours of the report of disease being received by the Ministry. Preliminary disinfection is proceeded with immediately, and a thorough disinfection of the premises is carried out immediately after slaughter has been completed. Infected premises are subject to the rules contained in Article 7 of the Foot-and-mouth Disease Order of 1928, which are maintained in force for a period of about eleven weeks from the date of slaughter.

Within the infected area a patrol staff of whole-time Veterinary Inspectors of the Ministry are employed to visit and inspect all stock in the immediate vicinity of an outbreak in order to discover any hidden centres of disease, and for the purpose of tracing suspected contacts to the diseased animals which have been moved from the infected premises during the preceding period of danger. Inspectors engaged on this work have very explicit instructions to carry out a thorough disinfection of their clothes after each inspection. Inspectors actually engaged on an infected place are not employed in this patrol work.

Every attempt is made to trace the origin of infection, both as regards the primary outbreak and any subsequent ramifications. It will be seen from the foregoing that the success of the measures adopted against foot-and-mouth disease must, as in most contagious diseases of animals, depend in a great degree, firstly, upon the promptitude with which notification is made to the authorities, and, secondly, on the efficiency with which the restrictions on movement are carried out. Public notices and placards are exhibited in all suitable places from time to time, and distributed to stockowners calling their attention to their duty of prompt notification of suspected cases. Failure to notify may be, and usually is, followed by a substantial reduction in the amount of compensation paid to the owner of animals slaughtered, irrespective of any penalty imposed by the Courts. It is therefore to the interest of every stockowner to report suspected cases of disease without delay.

It is recognized that the proper procedure is to deal effectively with the disease with the least possible interference with trade, but it is obvious that the necessary restrictions, such as the stoppage of dangerous markets, &c., in dealing with a disease so extraordinarily contagious as foot-and-mouth disease cannot be framed without imposing considerable restrictions on trade.

The operations against foot-and-mouth disease have been the subject of a thorough investigation and consideration by departmental Committees in 1912, 1922, and 1924–25, and the measures described above are in agreement with the recommendations of the last Committee, whose report was issued on the 2nd February, 1925 (Cmd. 2350). These measures have been accepted and supported loyally by British agriculturists as necessary, having regard to the present knowledge of the disease to effect its eradication. Meanwhile, the Foot-and-mouth Disease Research Committee appointed by the Minister of Agriculture in 1924, consisting of eminent scientists, is actively pursuing its labours to extend the knowledge of the disease and thereby, if possible, to improve the methods of dealing with it.

"*Herbage Abstracts.*"—We have received from the Imperial Bureau of Plant Genetics (Herbage Plants), Aberystwyth, Wales, the first issue of its new quarterly publication bearing the above title. *Herbage Abstracts*, it is advised, will deal with herbage and certain forage crops not only from the point of view of the plant-breeder, but also from that of the agronomist. Such subjects as field trials, seed-production, weed-control, and all aspects of grassland and pasture management will be dealt with rather fully, while information regarding morphology, physiology, ecology, &c., will be introduced when it is considered desirable. Each number will also contain a section of miscellaneous notes, short extracts from official reports, and proceedings of conferences, which might be of value to the worker on herbage and forage crops and general grassland. The subscription is 1s. 6d. per copy or 5s. per annum.

SYSTEMATIC CONTROL OF CONTAGIOUS MAMMITIS.

THE Live-stock Division of the Department of Agriculture has initiated a systematic method of dealing with contagious mammitis in dairy herds, and a number of farmers have agreed to carry out the method this season in co-operation with the field officers of the Division. The method is based, firstly, on microscopical examination of the milk of each cow in the herd; secondly, on the milking of the cows in a regular order, in which the clean animals are milked first, those slightly affected next, and those definitely affected last. Careful precautions are also taken to ensure the best possible sanitation and cleanliness throughout. The system was tried out last year in a very limited number of herds by Mr. T. A. Blake, M.R.C.V.S., Veterinary Research Officer, Hamilton, and the results were most encouraging. So far as this season has gone, the herds under trial have wonderfully improved. The method of microscopical examination of the milk was elaborated at the Wallaceville Veterinary Laboratory, and the results so far secured indicate its great reliability.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING SEPTEMBER, 1931.

FOLLOWING is a list of those crops which have been subjected to and have passed the tuber inspection during the month of September. This is the final list for the 1930–31 season. Previous lists have appeared in the *Journal* for June, July, August, and September.

Aucklander Short-top.

Jellie, J., Russley Road, Fendalton, Christchurch. (Line B.)
Cox, S., Willowbridge.
Haines, C., 108 Waimak Road, Harewood, Christchurch.

Aucklander Tall-top.

Simmons, W., Kingsdown, Timaru.

Dakota.

Murphy, H. E., R.M.D., Weedons.
Hearn, F. W., Rangitata Island.

King Edward.

McLeary, J., Mataura Island.

NOTE.—Merchants and others ordering seed from growers included in the above and previous lists are advised to state definitely "certified seed" when ordering. This stipulation would ensure that the sacks would have certification labels attached, thus affording a guarantee that the tubers are from a certified crop. Seed so ordered, if delivered in sacks without an official certification label attached, should not be accepted as certified seed.

—*Fields Division.*

KILLINGS AT MEAT-EXPORT WORKS.

THE following table, compiled from Meat Producers Board statistics, gives particulars of aggregate killings and/or equivalent output at meat-export works in New Zealand for the past five years ended 30th September:—

Year ended 30th September.	Beef Quarters.	Mutton Carcasses.	Lamb Carcasses.	Pork Carcasses.	Boned Beef = Freight Carcasses.	Frozen Sundries = Freight Carcasses.	Total Equivalent in 60 lb. Freight Carcasses.
1926–27	184,331	2,094,354	5,381,121	74,633	242,044	69,534	5,956,708
1927–28	394,821	2,005,333	5,947,197	147,601	283,749	125,200	6,998,086
1928–29	151,115	1,751,979	5,971,557	159,297	161,597	153,331	6,152,695
1929–30	177,379	2,621,275	6,925,859	133,591	194,311	229,673	7,506,227
1930–31	143,169	2,132,532	7,783,528	132,400	266,315	307,461	7,358,865